Dash® 3000/4000
Patient Monitor

Service Manual

2000966-270 Revision B

GE Medical Systems
Information Technologies

gemedical.com

NOTE: The information in this manual only applies to Dash 3000/4000 patient monitor software Version 5 and later. Due to continuing product innovation, specifications in this manual are subject to change without notice.

NOTE: The assembly drawings in this manual only support monitors with the **AAB** product code. Monitors with the **AAB** product code are only compatible with software version 5 and later.

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1 Introduction

For your notes

Manual Information

Revision History

Each page of this manual has the document part number and revision letter at the bottom of the page. The revision letter identifies the document's update level. The revision history of this document is summarized below.

Revision History		
Revision	Date	Comment
A	30 October 2003	Initial release of this manual.
B	03 February 2004	Release of software version 5.1.

Manual Purpose

This manual supplies technical information for service representatives and technical personnel so they can maintain the equipment to the assembly level. Use it as a guide for maintenance and electrical repairs considered field repairable. Where necessary the manual identifies additional sources of relevant information and technical assistance.

See the operator's manual for the instructions necessary to operate the equipment safely in accordance with its function and intended use.

Intended Audience

This manual is intended for service representatives and technical personnel who maintain, troubleshoot, or repair this equipment.

Safety Information

Responsibility of the Manufacturer

GE is responsible for the effects of safety, reliability, and performance only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by GE.
- The electrical installation of the relevant room complies with the requirements of the appropriate regulations.
- The equipment is used in accordance with the instructions for use.

General

This device is intended for use under the direct supervision of a licensed health care practitioner.

This device is not intended for home use.

Federal law restricts this device to be sold by or on the order of a physician.

Contact GE for information before connecting any devices to the equipment that are not recommended in this manual.

Parts and accessories used must meet the requirements of the applicable IEC 601 series safety standards, and/or the system configuration must meet the requirements of the IEC 60601-1-1 medical electrical systems standard.

Periodically, and whenever the integrity of the device is in doubt, test all functions.

The use of ACCESSORY equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:

- use of the accessory in the PATIENT VICINITY; and
- evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate IEC 60601-1 and/or IEC 60601-1-1 harmonized national standard.

If the installation of the equipment, in the USA, will use 240V rather than 120V, the source must be a center-tapped, 240V, single-phase circuit.

Warnings, Cautions, and Notes

The terms danger, warning, and caution are used throughout this manual to point out hazards and to designate a degree or level or seriousness. Familiarize yourself with their definitions and significance.

Hazard is defined as a source of potential injury to a person.

DANGER indicates an imminent hazard which, if not avoided, will result in death or serious injury.

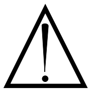
WARNING indicates a potential hazard or unsafe practice which, if not avoided, could result in death or serious injury.

CAUTION indicates a potential hazard or unsafe practice which, if not avoided, could result in minor personal injury or product/property damage.

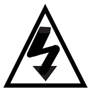
NOTE provides application tips or other useful information to assure that you get the most from your equipment.

Equipment Symbols

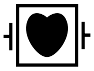
Some of the following symbols appear on the equipment.



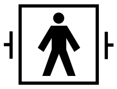
ATTENTION: Consult accompanying documents before using the equipment.



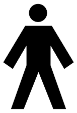
In Europe, this symbol means dangerous or high voltage. In the United States, this symbol represents the caution notice below:
To reduce the risk of electric shock, do NOT remove cover (or back). Refer servicing to qualified personnel.



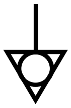
Defibrillator-proof type CF equipment; type CF equipment is specifically designed for applications where a conductive connection directly to the heart is established. The paddles indicate the equipment is defibrillator proof.



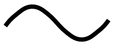
Defibrillator-proof type BF equipment; type BF equipment is suitable for intentional external and internal application to the patient, excluding direct cardiac application. Type BF equipment is type B equipment with an F-type isolated (floating) part. The paddles indicate the equipment is defibrillator proof.



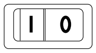
Type B equipment; type B equipment is suitable for intentional external and internal application to the patient, excluding direct cardiac application.



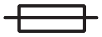
Equipotential Stud: A ground wire from another device can be tied here to ensure the devices share a common reference.



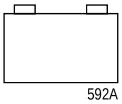
Alternating current (AC)



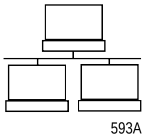
Power; **I** = ON; **O**= OFF



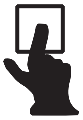
Fuse



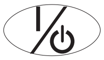
Battery



Indicates the Ethernet connection for the monitor.

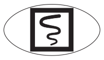


Press to open.



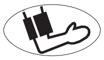
814A

POWER



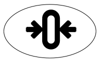
815A

GRAPH GO/STOP



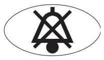
816A

NBP GO/STOP



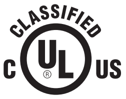
817B

ZERO ALL



818A

SILENCE ALARM/ADMIT



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Medical Equipment
With respect to electric shock, fire and mechanical hazards only in accordance with UL 2601-1, and CAN/CSA C22.2 NO. 601.1.

Service Information

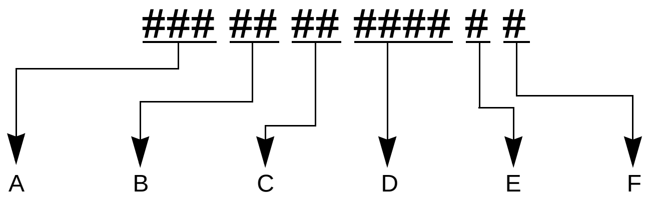
Service Requirements

Follow the service requirements listed below.

- Refer equipment servicing to GE-authorized service personnel only.
- Any unauthorized attempt to repair equipment under warranty voids that warranty.
- It is the user's responsibility to report the need for service to GE or to one of their authorized agents.
- Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.
- Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required.

Equipment Identification

Every GE device has a unique serial number for identification. A sample of the information found on a serial number label is shown below.



	Description
A	product code[1]
B	year manufactured
C	fiscal week manufactured
D	production sequence number
E	manufacturing site
F	miscellaneous characteristic

1. The product code for the Dash 3000/4000 patient monitor is **AAB**.

2 Equipment Overview

For your notes

Components

The Monitoring System

The monitor can function by itself with a built-in writer, or it can be cabled in with the optional Unity Network® via Ethernet. Optional components are, if using Wireless LAN or cabled to Ethernet, a Centralscope™ central station and the Clinical Information Center.

The Patient Monitor

This device is designed to monitor a fixed set of parameters including ECG, noninvasive blood pressure, impedance respiration, SpO2, and temperature. Invasive pressure and EtCO2 are optional features. Additional specialized features include cardiac output, cardiac calculations, pulmonary calculations, dose calculations, PA wedge (PA wedge is only available with the invasive pressure option), ICG module interface, and SAM® module interface.

Dash 3000
Power
Charging Status
Graph
NBP Go/Stop
Zero All
Trim Knob
Silence Alarm/Admit
001C

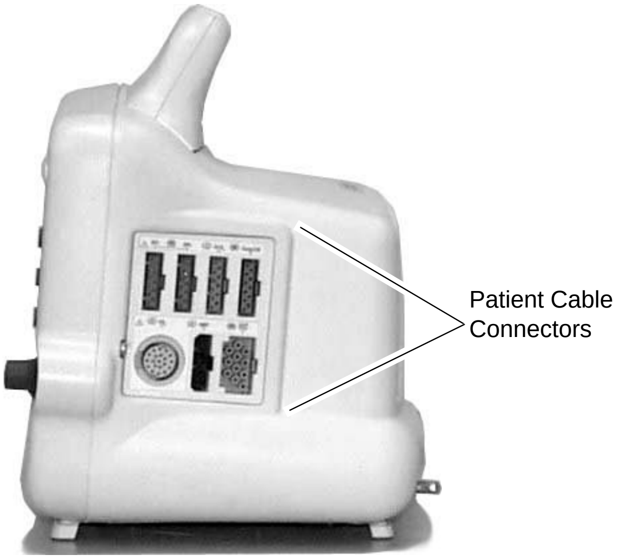
Dash 3000 Monitor

Charging Status
Power
Graph Go/Stop
NBP Go/Stop
Zero All
Silence Alarm/Admit
Dash 4000
051D

Dash 4000 Monitor

Right Side View

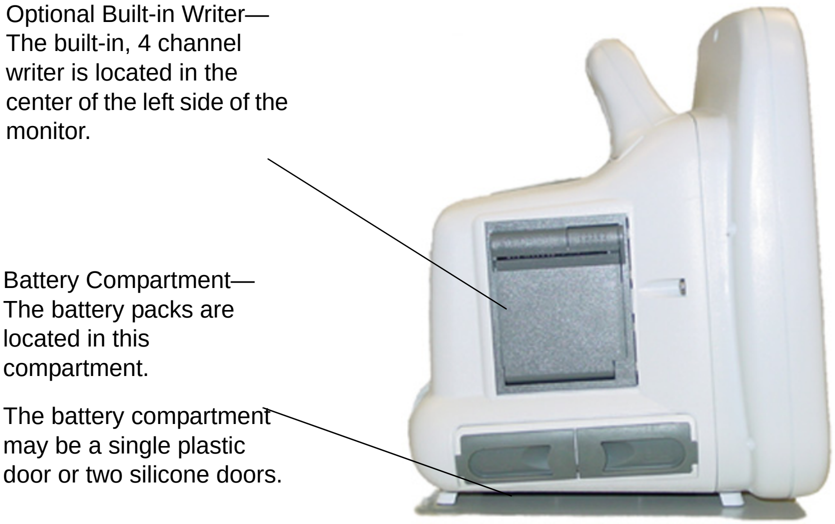
All of the patient cable connectors are located on the right side of the monitor. A **Trim Knob**® control provides single control operation of virtually all monitor functions.


Patient Cable
Connectors

002A

Left Side View

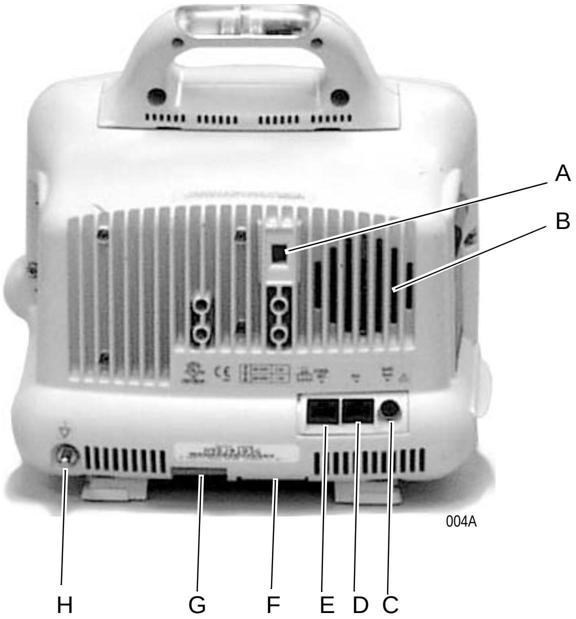
On the left of the monitor, you can find the built-in writer and the battery compartment.


Optional Built-in Writer—
The built-in, 4 channel
writer is located in the
center of the left side of the
monitor.
Battery Compartment—
The battery packs are
located in this
compartment.
The battery compartment
may be a single plastic
door or two silicone doors.

925A

Back View

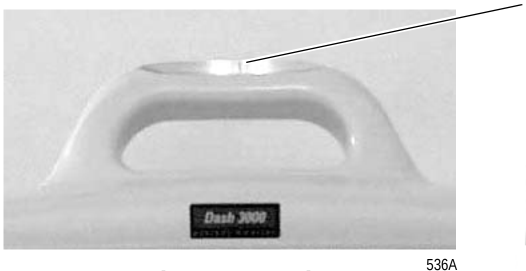
On the back of the monitor you will find all connectors for equipment and network.



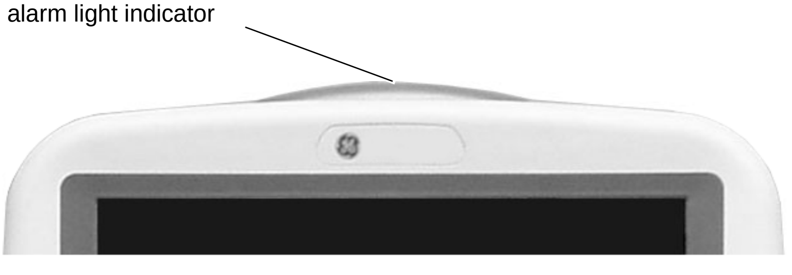
	Name	Description
A	line voltage selector	This selector is factory set to match the line voltage rating for your country.
B	audible alarm enunciator	The internal speaker provides sound for audible alarms. For better sound quality do not block speaker.
C	**Defib Sync** connector	Provides ECG analog output signals to user-supplied equipment. A 5-volt, 2-millisecond artificial pacer spike is added to the analog output when PACE is on and detection occurs.
D	**Aux** port	Used for RAC 2A and other compatible auxiliary devices.
E	**Ethernet** connector	Used to connect a monitor to a network configuration or for downloading software.
F	peripheral expansion port	Used for connectiong to a Dash Port® docking station or other compatible auxilliary devices.
G	AC power connector	Used for connecting an AC power cable.
H	equipotential terminal	For measurements in or near the heart we recommend connecting the monitor to the potential equalization system. Use the green and yellow potential equalization cable and connect it to this pin.

Optional Alarm Light Indicator

An optional alarm light indicator can be built into the handle of the Dash 3000 monitor or into the display bezel of the Dash 4000 monitor. When activated, the LED indicator flashes red for Crisis patient status alarms and yellow for Warning patient status and system alarms.



Dash 3000 Monitor



Dash 4000 Monitor

User Interface

The User Interface consists of a flat panel display and the keypad assembly which consists of a **Trim Knob**, five function keys, and four LED indicators.

Flat Panel Display

The active-matrix color liquid crystal display (LCD) is assembled into a shock absorbing isolator that fits within the monitor's front bezel to protect the display from mechanical shock during use.

The acrylic optical filter protects the display panel from impact and enhances visibility with its non-glare surface coating on the viewing side of the filter. It also has a scratch-resistance surface coating.

Trim Knob Control

The **Trim Knob** control is a 24-position rotary control with a push selection switch.

Power Key

The monitor is powered at all times when it is plugged into AC power.

When the monitor is not plugged in to AC power, this key turns the monitor On and Off.

When AC power is present, this key toggles the operational mode of the monitor between normal operation and stand-by mode. In standby mode patient monitoring discontinues. Only the charging function continues and the charging status indicators operate as described below.

Function Keys

Fixed Keys

Four fixed function keys are provided for **GRAPH GO/STOP**, **NBP GO/STOP**, **ZERO ALL**, and **SILENCE ALARM/ADMIT**.

Indicators

While the monitor powers up or changes between normal mode and standby mode, all four front panel indicators illuminate.

AC Power Indicator

The indicator illuminates green when AC mains power is applied to the monitor (including when the monitor is in the standby mode). The indicator does not illuminate when the monitor is not powered by AC mains power.

Battery Power Indicator

The indicator illuminates yellow when the monitor is operating on battery power. The indicator does not illuminate when the monitor is not battery powered.

Charging Status Indicators

The following table explains what the Charging Status indicators mean.

LED Color	Explanation
Yellow	Two battery icons, labeled **Charging Status A** and **B**, illuminate yellow when the respective battery is being charged. If both batteries are present and require charging, then both icons illuminate yellow even though they charge sequentially.
Green	The icon illuminates green when the respective battery is fully charged.
No Light	The icon does not illuminate under the following conditions: ■ The respective battery is not installed. ■ The monitor is operating on battery power. ■ A failure condition has been detected for the respective battery.

"Battery In Use" Indicators

The "Battery In Use" indicator (inside the battery door) illuminates green when the monitor is receiving power solely from the respective battery. The indicators do not illuminate when the monitor is not battery powered.

Neither indicator illuminates when the monitor is operating from both batteries simultaneously (i.e., in a very low battery charge condition when both batteries are joined together in order to sustain operation of the monitor).

Optional RAC 2A Module Housing

The RAC 2A module housing currently supports the SAM and ICG modules.

An integral power supply is used to run the RAC 2A and support the needed voltages.

Optional Dash Port 2 Docking Station

The docking station is a quick mount/dismount base for a Dash patient monitor. It gives the monitor easy connect/disconnect access to AC power, the Unity Network®, to a remote display, and to auxiliary devices.

See the Dash Port 2 Docking Station Operating Instructions and the Dash Port 2 Docking Station Service Manual for additional information.

NOTE

> When a Dash monitor is connected to the docking station, only the docking station's Ethernet connector is active. The Dash monitor's network connector remains inactive until the monitor is disconnected from the docking station.

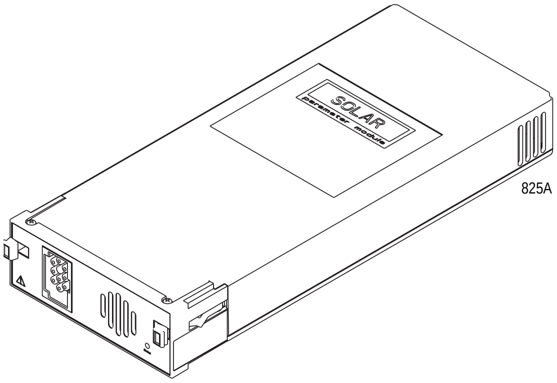
Dash Port 2
823B

An optional remote display can be connected to the system for viewing on a larger monitor, or in a separate room. The optional remote display:

- Requires Dash Port 2 docking station.
- Requires Dash 3000/4000 software version 5 or later.
- Must be within 150 feet of the Dash monitor.

Optional ICG Module

The ICG module (impedance cardiography) measures and processes patient hemodynamic data.



Optional Wireless LAN System

The flexibility of the optional GEUnity Network is increased by using the Wireless LAN system. The Wireless LAN system allows the user to roam from one access point to another, maintaining a strong, seamless connection to the Unity Network.

The monitor, with its optional built-in Wireless LAN, functionally performs the same as a monitor connected directly to the optional Unity Network. It can be viewed at the central station and by other GEmonitors on the network (i.e. Dash 3000/4000, Eagle® 4000, and Solar® patient monitors). Monitors with Wireless LAN sends and receives patient data via the access points of the Unity Network.

NOTE

> Wireless patient monitors that are moved from room to room must have the monitor type configured as Rover or Rover/Combo monitoring.

Access Points

To integrate the wireless network with the wired network, one or more access points are necessary. An access point connects the wireless monitor to the wired network infrastructure within the building, and acts as a bridge between the wired and wireless networks. The areas covered by each access point overlap to insure continuous coverage.

NOTE

The monitor will only work with a Symbol Access Point. The monitor will not communicate directly with a Wireless LAN device from Aironet.

Optional Remote Control

The optional remote control provides all patient monitor controls on a portable component with a **Trim Knob** control, and allows the user to operate the patient monitor from across the room. Eighteen hard keys are configured for adult, neonatal, or operating room applications.

Software Packages and Software Options

Software Packages

The Dash monitor comes configured with the Basic software package. This package consists of standard-of-care parameters, lethal arrhythmia detection, dose calculations, and features required by clinicians caring for acutely ill patients.

Two additional software packages can be purchased separately or in any combination. These packages provide a variety of features which allow the monitor to be configured to best meet the needs of its intended environment.

The Cardiac software package focuses on cardiac conductivity. Its features include full arrhythmia analysis and storage, as well as ST segment trending, storage, and templates. The ability to adjust the ST measurement point is also included in this package.

The Cardiopulmonary software package centers upon cardiac and pulmonary hemodynamics. Features include the PA insert and wedge algorithms, the intra-aortic balloon pump algorithm, and the thermodilution cardiac output algorithm, including predefined computation constants for the catheters of major manufacturers. Also included are cardiac and pulmonary calculations.

Software Options

Three software options can be purchased separately or in any combination with the software packages and software options.

The High Resolution CRG Trends option provides storage of up to 100 CRG events, and up to 24 hours of CRG trend data, in addition to the CRG feature set found in the Basic software package.

The 12SL™ ECG analysis program with Gender Specific Criteria and the Acute Cardiac Ischemia–Time Insensitive Predictive Instrument (ACI-TIPI) analysis option uses recorded ECG data to produce a numerical score which is the predicted probability of acute cardiac ischemia. In addition, the gender-specific criteria improves the detection of acute myocardial infarctions (AMI) in women.

The Unity Network option enables you to view other patients on the network, interface with a central station and other network devices, and perform Combo or Rover Combo monitoring.

Technical Specifications

Due to continual product innovation, specifications are subject to change without notice. The following specifications are accurate as of the date of this publication, and pertain to the monitor.

Performance Specifications

Display

Size: Dash 3000: Dash 4000:	 8.4-inch diagonal 10.4-inch diagonal
Type: Color:	 Active-Matrix Liquid Crystal Display (LCD)
Resolution:	640 by 480 pixels
Number of traces:	6 (maximum)
Number of seconds/trace: Dash 3000: Dash 4000:	 4.9 at 25 mm/sec 5.9 at 25 mm/sec
Sweep speed: All waveforms	 6.25, 12.5 or 25 mm/sec (with erase bar)
Waveform display options:	Individual 6 waveforms, individual 3 waveforms, full, and full grid modes
Information window:	Displays non-real-time information without obstructing the display of real-time information
Display organization:	Prioritized by parameter

Controls

Standard:	**Trim Knob** control plus 5 hard keys: POWER, NBP GO/STOP, ZERO ALL, SILENCE ALARM/ADMIT, and GRAPH GO/STOP.
Optional remote control	**Trim Knob** control and 18 active hard keys.

Alarms

Categories:	Patient Status and System Status
Priorities:	4 levels — Crisis, Warning, Advisory, and Message
Notification:	Audible and visual
Setting:	Default and individual
Silencing:	1 minute, current alarm only
Pause:	5 minutes (adult); 3 minutes (neonatal); 5, 15 minutes, permanent (OR mode)
Volume:	Default 70 dB measured at 1 meter

ECG

5 Leadwire cable:	I, II, III, V, aVR, aVL, and aVF
10 Leadwire cable (12SL option):	V2, V3, V4, V5 and V6
Leads analyzed simultaneously:	I, II, III, and V (multi-lead mode)
Lead fail:	Identifies failed lead
Alarms:	User-selectable upper and lower heart rate limits
Input specifications:	
Voltage range:	±0.5 mV to ±5 mV
Signal width:	40 ms to 120 ms (Q to S)
Heart rate range:	30 to 300 BPM
Accuracy:	±1% or ±1 BPM, whichever is greater
Input impedance:	
Common mode:	>10 MΩ at 50/60 Hz
Differential:	>2.5 MΩ from dc to 60 Hz
Common mode rejection:	90dB minimum at 50 Hz or 60 Hz
Output specifications:	
Heart rate averaging:	8 beats with a 2-second update rate of display
Frequency response:	Response of non-permanent displays is limited by resolution to 40 Hz (-3dB) @ 25 mm/s. Specified upper frequency limits may vary by ± 2 Hz.
Display:	
Diagnostic Mode:	0.67(+0.4 dB) to 100 Hz (-3 dB) For compliance with China National Standard: 1.0 Hz (+0.4 dB) to 75 Hz (-3 dB)
Monitoring Mode:	0.67 (+0.4 dB) to 40 Hz (-3 dB)
Moderate Mode:	0.67 (+0.4 dB) to 25 Hz (-3 dB)
Maximum Mode:	5.0 Hz (-3 dB) to 25 Hz (-3 dB)
Impulse Response:	For an impulse of 3 mV applied for 100 ms: Displacement following impulse: < 0.1 mV Slope following impulse: < 0.3 mV/s

ST segment measurement:	
Measurement point:	Adjustable from 0 to 80 ms past the J-point (default: 60 ms adult, 30 ms neonatal)
Measurement range:	–12.0 to +12.0 mm
Measurement accuracy:	±10% or 0.5 mm, whichever is greater
Pacemaker detection/rejection:	
Input voltage range:	±2 mV to ±700 mV
Input pulse width:	0.1 ms to 2 ms
Rise time:	10 µs to 100 µs
Over/under shoot:	2 mV (max)
Baseline drift:	<0.5 mV/hour with a ±700-mV, 2-ms pacemaker pulse applied

Invasive Blood Pressure (BP)

Number of channels:	2
Transducer sites:	Arterial (ART), femoral artery (FEM), pulmonary artery (PA), central venous (CVP), right atrial (RA), left atrial (LA), intracranial (ICP), and special (SP) In neonatal mode: umbilical artery catheter (UAC) and umbilical venous catheter (UVC)
Transducer requirements:	
Excitation voltage:	5.0 Vdc ±0.1%
Transducer output:	5 µV/V/mmHg
Input specifications:	
Range:	–25 mmHg to 300 mmHg
Offset:	±150 mmHg
Output specifications:	
Frequency response:	dc to 50 Hz
Zero balance range:	±150 mmHg
Zero balance accuracy:	±1 mmHg
Zero balance drift:	±1 mmHg over 24 hours
Accuracy:	±2% or ±1 mmHg, whichever is greater (exclusive of transducer)
Alarms:	User-selectable upper and lower limits for systolic, diastolic, and mean pressures

Noninvasive Blood Pressure (NBP)

Measurement technique:	Oscillometric
Displayed parameters:	Systolic, diastolic, and mean pressures, pulse rate, time of last measurement
Measurement modes:	Manual, auto, and stat in adult and OR modes; manual and auto in neonatal mode
NBP pressure range:	
Systolic pressure range	
Adult:	30 to 285 mmHg
Pediatric:	30 to 235 mmHg
Neonatal:	30 to 140 mmHg
Diastolic pressure range	
Adult:	10 to 220 mmHg
Pediatric:	10 to 210 mmHg
Neonatal:	10 to 110 mmHg
Mean pressure range	
Adult:	20 to 260 mmHg
Pediatric:	20 to 220 mmHg
Neonatal:	20 to 125 mmHg

Cuff pressure range: Adult: Pediatric: Neonatal:	 294 ± 6 mmHg 250 ± 5 mmHg 147 ± 3 mmHg
Pressure accuracy: Static: Clinical:	 ±2% or ±3 mmHg, whichever is greater ±5 mmHg average error 8 mmHg standard deviation
Heart rate detection:	30 to 200 beats per minute
Total cycle time:	20 to 40 seconds typical (dependent on heart rate and motion artifact)
Automatic cycle times:	0 to 8 hours
Auto zero:	Zero pressure reference prior to each cuff inflation
Tubing length: Adult: Neonatal:	 12 feet 8 feet
Automatic cuff deflation:	Cycle time exceeding 3 minutes (90 seconds neonatal), power off, or cuff pressure exceeds 294 mmHg (±6 mmHg) adult, 147 mmHg (±3 mmHg) neonatal
Cuff sizes: Disposable: Reusable:	 Large adult, adult, small adult, pediatric, small pediatric, and infant Thigh, large adult, adult, child, and infant
Alarms:	User-selectable upper and lower limits for systolic, diastolic, and mean pressures

GE Pulse Oximetry (SPO2)

Parameters monitored:	Arterial oxygen saturation (SpO2) and peripheral pulse rate (PPR)
Measurement Range SPO2: PPR:	 50 - 100% 30 - 300 beats per minute
Accuracy SpO2: PPR:	Actual accuracy depends on probe. Please reference manufacturer's specifications. ± 2% (70 - 100% SpO2) ±1 standard deviation ± 3% (50 - 69% SpO2) ±1 standard deviation ± 3 beats per minute
Alarms:	User-selectable upper and lower limits for SpO2 and PPR.

Masimo SET SPO2 Module

Display Messages	*LOW QUALITY, PROBE IS OFF THE PATIENT, PROBE OR MODULE MALFUNCTION, PULSE SEARCH*
Measurement Range Saturation: Pulse Rate: Perfusion:	 30 to 100% SpO_2 25 to 240 beats per minute 0.02 to 20%
Accuracy Displayed saturation data Saturation, no motion: Saturation, motion: Pulse Rate, no motion: Pulse Rate, motion:	 Functional saturation SpO_2 over the range 70 to 100%, below 69% is unspecified ±2 digits for adults and pediatrics, ±3 digits for neonates SpO_2 over the range 70 to 100%, below 69% is unspecified ±3 digits for adults, pediatrics, and neonates 25 to 240 bpm, ±3 bpm 25 to 240 bpm, ±5 bpm
Alarms:	User-selectable upper and lower limits for SpO2 and PPR.
Patents	5482036, 5490505, 5632272, 5685299, 5769785, 6002952, 6036642, 6067462, 5,758,644; 6206830; 6157850.

Cardiac Output (CO)

Availability:	Included in 7020 and 7025 software packages. Not available in 7015 software package.
Input specifications:	
Probe type:	In-line or bath probe
Catheter manufacturers:	Abbott, Arrow, Baxter, Ohmeda, or other
Catheter sizes:	
Abbott catheter sizes:	5.5F (75 cm), 7F (85 cm), 7.5F (110 cm), and 8F (110 cm)
Arrow catheter sizes:	5, 6, 7, or 7.5F
Baxter catheter sizes:	5, 6, 7, 7.5 or 8F
Ohmeda catheter sizes:	5, 7, or 7.5F
Other catheter sizes:	Cardiac coefficient entered manually
Injectate volume:	3, 5, or 10 cc
Output specifications:	
Parameters displayed:	Cardiac output, blood temperature, injectate temperature, trial number
Range:	
Cardiac output:	0.2 - 15 liters per minute
Blood temperature:	30 - 42°C
Injectate temperature:	0 - 30°C
Accuracy:	
Cardiac output:	±5% (liters of blood/min)
Blood temperature:	±0.2°C
Injectate temperature:	±0.3°C
Frequency response:	dc to 15 Hz ±2 Hz

Respiration

Measurement technique:	Impedance variation detection
Range:	
Respiration rate:	0 - 200 breaths per minute
Base impedance:	100 - 1000 Ω at 52.6 kHz excitation frequency
Detection sensitivity:	0.4 to 10 Ω variation
Accuracy:	
Respiration rate	±1 BrPM
Waveform display bandwidth:	0.1 to 1.8 Hz (–3 dB)
Alarms:	User-selectable upper and lower respiration rate limits, and user-selectable apnea limit

Temperature (TEMP)

Number of channels:	2
Input specifications: Probe type: Temperature range: Resolution:	 YSI Series 400 or 700 thermistor (determined by input cable) 0°C to 45°C (32°F to 113°F) ±0.1°C
Output specifications: Parameters displayed: Accuracy: Alarms:	 T1, T2 (independent of source) ±0.1°C for YSI series 400 probes; ±0.3°C for YSI series 700 probes User-selectable upper and lower limits for T1, T2

Carbon Dioxide (CO2)

Information displayed:	Inspired and expired carbon dioxide concentrations in %, mmHg or kPa, respiration rate, continuous CO2 waveform
Measurement technique:	Non-dispersive infrared absorption, dual wavelength ratiometric
Sensor type:	Novametrix Medical Systems' Capnostat III
Patient interface:	Compatible with Novametrix Medical Systems' Capnogard monitoring product
Airway adaptors Types: Dead space/chamber volumes: Adult reusable: Adult disposable: Neonatal:	 Adult reusable (standard), adult disposable, neonatal <5 cc <5 cc <0.5 cc

CO2 measurement specifications:	
Measurement range:	
Pi CO2/Fi CO2:	0 to 100 mmHg/0 to 13%
Pe CO2/Fe CO2:	0 to 100 mmHg/0 to 13%
RR:	0 to 120 breaths/min
Accuracy:	±5% of reading or ±2 mmHg, whichever is greater
Display update interval:	2 sec
CO2 waveform sweep speed:	Selectable 6.25, 12.5, or 25 mm/sec
CO2 averaging:	Selectable from single breath, 10 sec, or 20 sec
CO2 measurement stability:	Accuracy maintained over 8 hours
Resolution:	1 mmHg
Noise:	2% of reading or 0.5 mmHg (maximum), whichever is greater
60 Hz interference:	<0.5 mmHg at 38 mmHg
Step response time:	
Adult:	<60 ms (10-90%)
Neonatal	<50 ms (10-90%)
Interference:	
N2O gas:	±5% of reading or ±2 mmHg (maximum), whichever is greater, with N2O compensation enabled
O2 gas:	±5% of reading or ±2 mmHg (maximum), whichever is greater, with O2 compensation enabled
Barometric pressure:	±2 mmHg (maximum) from 500 to 800 mmHg
Water vapor:	±1.5% of reading or ±0.5 mmHg (maximum), whichever is greater
Anesthetic agent:	±0.5 mmHg (maximum) for concentration of no more than 5% of halogenated agents
Airway adapter variability:	±3% of reading or ±1.5 mmHg (maximum), whichever is greater, with same or different adapter; not applicable after adapter zero
Warm-up time:	Less than 15 seconds to initial CO2 indication, full specification within 120 seconds; waveform immediate upon power up
Calibration:	
Factory settings:	Factory calibration settings stored in nonvolatile memory within the sensor; 15 second adaptor calibration when switching airway types
Verification:	Zero and span performance check with on-cable verifier
Respiration rate specifications:	
Range (for 5% step size):	0-120 breaths per minute
Accuracy:	±1 breath per minute
Resolution:	±1 breath per minute
Barometric pressure sensor specifications:	
Range:	530 to 785 mmHg (70.7 to 104.7 kPa)
Accuracy:	±25 mmHg
Alarms:	User-selectable upper and lower limits for CO2 and RR.

Analog Output

ECG:	
Gain:	1 V/mV ±10%
DC offset:	±100 mV (max)
Noise:	<5 mVp-p (0-300 Hz)
Frequency response:	In the “ECG” section, refer to the “Output specifications:” on page 2-13.
Time delay:	40 ms monitoring filter, 35 ms diagnostic filter
Blood pressure:	
Gain:	10 mV/mmHg ±2%
DC offset:	±20 mV (max)
Noise:	<5 mVp-p (0-300 Hz)
Frequency response:	dc to 50 Hz +2/–0 Hz
Time delay:	40 Hz filter, 37 ms

Defibrillator Synchronization Pulse

Marker out:	
Time delay:	35 ms (maximum), R-wave peak to leading edge of pulse.
Amplitude (selectable in Service menu):	
+5 V selection:	3.5 V (min) at 1 mA sourcing; 0.5 V (max) at 5 mA sinking.
+12 V selection:	11.0 V (min) at 1 mA sourcing; 0.75 V (max) at 5 mA sinking.
Pulse width:	10 ms ±10% or 100 ms ±10% (selectable in Service menu).
Output impedance:	50 Ω nominal
Current limit:	15 mA nominal, both sourcing and sinking.
Marker in:	
Input threshold:	V_{IH} = ±2.5 V (min); V_{IL} = ±1.5 V (max)
Input hysteresis:	650 mV typical
Maximum input voltage:	±30 V (with respect to ground on pin 3)
Input impedance:	10 kΩ (min) for -25 V < VIN < 25 V
Pulse width:	1.0 ms (min), VIN > 2.5 V

Battery

Battery type:	Exchangeable Lithium-Ion
Number of batteries:	2
Battery weight:	0.36 kg (0.8 lbs) each
Voltage:	11.1 V (nominal)
Capacity:	≥3.45 Ah
Charge time:	Less than 4 hours each
Run time:	4 to 5 hrs NOTE When a battery functions at 100% design capacity and at 100% full charge capacity, the expected run time for a single battery is approximately 3.5 hours. And the expected run time for two batteries is approximately 7.0 hours.

Paper Recorder

Method:	Thermal dot array
Horizontal resolution:	480 dots/in at 25 mm/sec
Vertical resolution:	200 dots/in
Number of waveform channels:	4
Paper width:	50 mm (1.97 in)
Paper length:	30 m (100 ft)
Paper speed:	0.1, 0.5, 1, 5, 10, 12.5, 25, and 50 mm/sec (± 2%)

RF Wireless LAN

Transmission technique:	Frequency hopping spread spectrum
Frequency:	Country dependent, specific settings received from access point. Within 2400 to 2500 MHZ range.
Frequency hopping characteristics:	Country dependent, specific settings received from access point. IEEE 802.11 compliant
Radio data rate:	1 and 2 Mbps
Radio output power:	160 mW (including antenna gain)
1 Mbps range:	Open environment: over 850 ft. (260) Typical hospital environment: between 150 and 200 ft. (45 to 60 m)

2 Mbps range:	Open environment: over 425 ft. (130) Typical hospital environment: between 100 and 150 ft. (30 to 45 m)
Modulation:	Binary GFSK
Applicable standards:	US: FCC Part 15 Class B Europe: ETS 300 328 and ETS 300 826

Environmental Specifications

NOTE

> The system may not meet its performance specifications if stored or used outside the manufacturer's specified temperature and humidity range.

Power requirements:	
90-132VAC	50/60 Hz 2.0A
190-264 VAC	50/60 Hz 1.0A
Power consumption:	75 watts (fully loaded)
Cooling:	Convection
Heat dissipation:	240 Btu/hr (max)
Battery operation time:	
General:	Battery age will affect operating time.
Operating conditions:	
Ambient temperature:	0 to 40°C (32 to 104°F)
While charging batteries:	0 to 35°C (32 to 95°F)
Capnostat III sensor	10° to 40° C (50° to 104°F)
Relative humidity:	5 to 95% at 40°C
Vibration:	MIL-STD 810E, Method 514.4, Category 1
Altitude:	-273.10 m to 2,942.84 m (-896 ft to 9655 ft)
Storage conditions (Do not exceed):	
Maximum:	70°C (158°F) at 95% relative humidity
Minimum:	–40°C (–40°F) at 15% relative humidity
CO2 Sensor:	–30 to 65°C (–22 to 149°F)
Batteries:	–20 to 60°C (–4 to 140°F)
Equipment Type:	Portable per IEC 60601-1

Physical Specifications

Height:	
Dash 3000	26 cm (10.25 inches)
Dash 4000	27.38 cm (10.78 inches)
Width:	
Dash 3000	28 cm (11.0 inches)
Dash 4000	29.26 cm (11.5 inches)

Depth:	
Dash 3000	20 cm (8 inches)
Dash 4000	24.26 cm (9.55 inches)
Weight (without batteries)	
Dash 3000	5.08 kg (11.2 lbs)
Dash 4000	5.53 kg (12.2 lbs)

Certification

Safety

UL 2601-1 classified.
UL classified for CAN/CSA C22.2 No. 601.1
IEC 60601-1 and EN 60601-1 Certified
CE marking for Council Directive 93/42/EEC concerning medical devices
Radio and Telecommunication Terminal Equipment Directive

Electromagnetic Compatibility Compliance (EMC)

The Dash 3000/4000 system meets the requirements of EN 60601-1-2 (1993–04) Medical Electrical Equipment, Part 1: General Requirements for Safety, 2. Collateral Standard: Electromagnetic compatibility—Requirements and tests.

Exceptions

CO2 Parameter — EN 60601-1-2 clause 36.202.1—IMMUNITY: Radiated Immunity:

- The level of compliance is 1 volt per meter. If operating under the conditions defined in EMC Standard EN60601-1-2 (Radiated Immunity 3 volts per meter), field strength above 1 volt per meter may cause waveform distortions and erroneous numeric data at various electromagnetic interference (EMI) frequencies.

Recommendations

Review the AAMI EMC Committee technical information report (TIR-18) titled Guidance on electromagnetic compatibility of medical devices for clinical/biomedical engineers - Part 1: Radiated radio-frequency electromagnetic energy. This TIR provides a means to evaluate and manage the EMI environment in the hospital.

The following actions can be taken:

- managing (increasing) distance between sources of EMI and susceptible devices.
- managing (removing) devices that are highly susceptible to EMI
- lower power from internal EMI sources under hospital control (i.e. paging systems)
- labeling devices susceptible to EMI
- educate staff (nurses and doctors) to be aware of, and to recognize, potential EMI related problems

FCC Compliance Information Statement

This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

WARNING
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

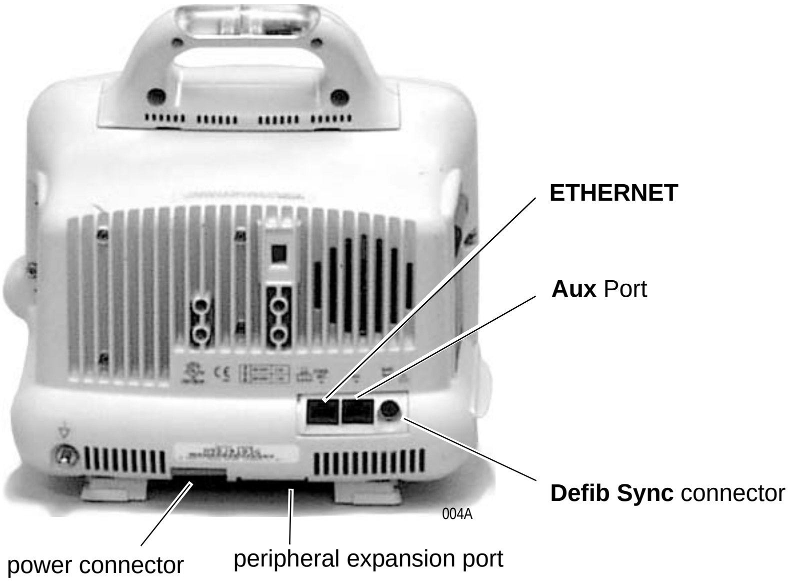
3 Installation

For your notes

Connections

Back Panel Connections

On the back of the monitor you will find all connectors for equipment and network.


ETHERNET
Aux Port
Defib Sync connector
004A
power connector
peripheral expansion port

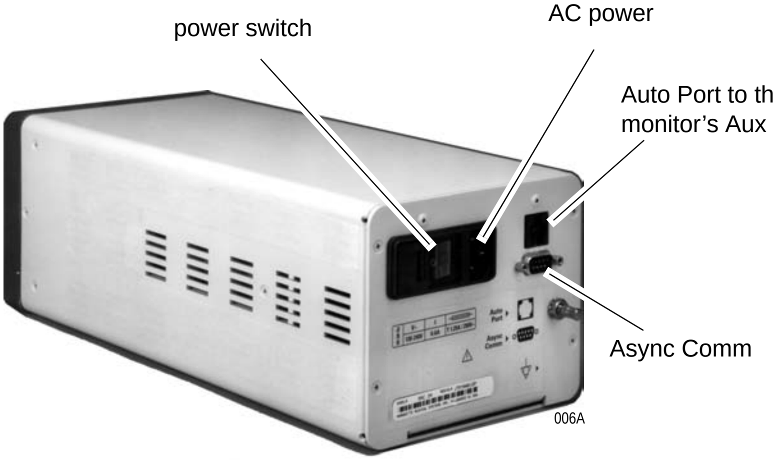
ETHERNET

The **ETHERNET** connector provides an ANSI/IEEE 802.3 10BaseT Ethernet standard interface to the Unity Network.

RAC 2A Housing Connectors

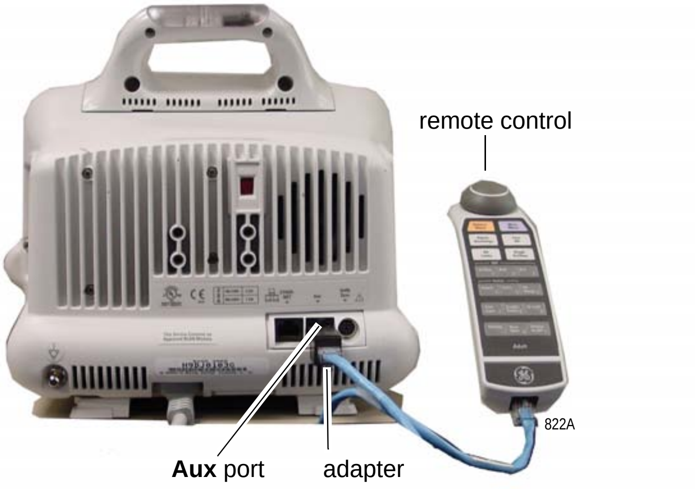
The RAC 2A module housing connects to the monitor via a standard category 5 patch cable (PN 418335-002) which plugs into the **Aux** port on the monitor and to the Auto Port on the back of the RAC 2A module housing.

The RAC 2A module housing does not have an Analog Output connector.


power switch
AC power
Auto Port to the monitor's Aux Port
Async Comm
006A

Remote Control

The remote control connects to the monitor via a communications cable which plugs into an Autoport to Mport adapter before it is inserted into the **Aux** port on the Dash monitor or the Dash Port docking station.


remote control
822A
Aux port
adapter

The remote control is programmed for specific care areas (adult, neonatal, or operating room).

NOTE

> The error message *WARNING: REMOTE MISMATCHED WITH MONITORING MODE* displays if a mismatched remote control is connected to the monitor.

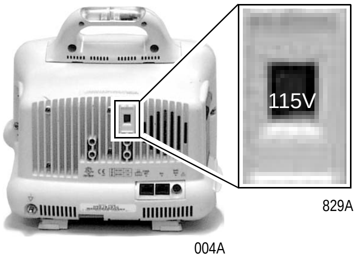
Defib Sync

The connector provides ECG analog output signals to user-supplied equipment.

CAUTION
Equipment damage. Connect all peripheral equipment before plugging the power cord into an AC outlet. Otherwise, connectors may be damaged.

AC Power

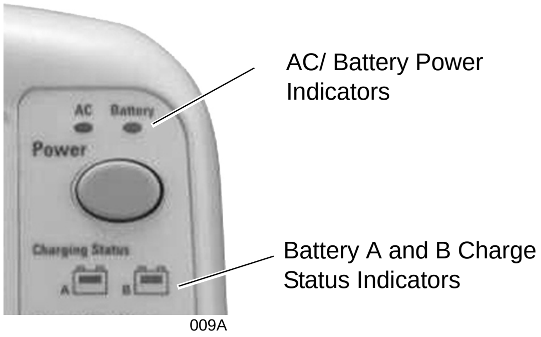
Use this connector to apply power to the monitor. The monitor will be powered at all times when using AC power (there is no AC power switch). The monitor is preset at the factory for a specific line voltage. Before applying power, verify the monitor's line voltage setting matches your power supply. If required, use a small bladed screw driver to change the line voltage setting. Refer to the label on the back of the unit for the voltage and current requirements.



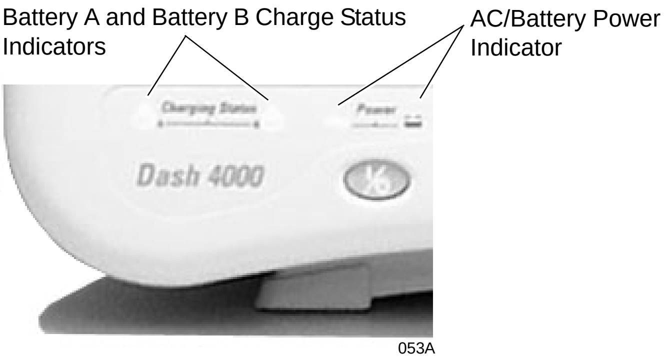
line voltage selector:
115V for a 100-120V power source
230V for a 220-240V power source

Front Panel Indicators

Power and battery indicators are located on the front panel of the monitor.


AC/ Battery Power Indicators
Battery A and B Charge Status Indicators
AC
Battery
Power
Charging Status
A
B
009A

Dash 3000 Monitor’s Front Panel


Battery A and Battery B Charge Status Indicators
AC/Battery Power Indicator
Charging Status
Power
Dash 4000
053A

Dash 4000 Monitor’s Front Panel

AC Power Indicator

The indicator illuminates green when AC power is applied to the monitor. The indicator is not illuminated when the monitor is not powered.

Battery Power Indicator

The indicator illuminates yellow when the monitor is battery powered. The indicator is not illuminated when the monitor is not powered or when AC power is applied.

Battery Charging/Ready Indicators

An icon for each battery pack indicates its charging status. The battery icon illuminates yellow when the respective battery is being charged. If both batteries are present and require charging, then both icons will illuminate even though they will be charged sequentially. The battery icon illuminates green when the respective battery is fully charged.

When the monitor is operating under battery power, the battery icons will not be illuminated. The icons are also not illuminated when the respective battery is either not being charged, not installed, or has failed.

NOTE

No specific information is given to distinguish a failed battery pack condition from a condition where the battery is not installed or is not being charged.

Power Up

After making all connections, plug the power cord into an AC wall outlet.

When all cables are properly connected, press the **POWER** button to turn the monitor on. All front panel indicators will illuminate until the power-up sequence is complete. After approximately 10 seconds you should see a display on the screen.

Optional Ethernet Communication

Overview

Ethernet is a local area network used as the main link of the optional GE Unity Network, a comprehensive information communication system. The Unity Network offers the high rate of communication of 10 megabits per second. The Ethernet connector connects to an Ethernet transceiver directly or via a transceiver cable. This local area network links all patient monitors, central stations, and other GEequipment throughout the hospital. Depending on the construction of the hospital, thick-net, thin-net, or twisted pair cabling is used.

Twisted Pair

Twisted pair is the most popular cabling because it is easy to install and flexible to work with. It uses the star topology with a concentrator as the hub of the segment. Each of the network devices is connected directly to the concentrator so longer lengths of cable are required. A maximum of 100 meters or 328 feet is the longest length of twisted pair cable used. The number of devices is limited to the amount of connectors at the concentrator.

Concentrator

The concentrator is simply a transceiver that passes all network data between any two branches in the LAN. Note that the concentrator passes all network data between the two branches, regardless of whether or not one node is sending data to another node on the same branch.

To implement the star topology, each network device is connected to a concentrator. The concentrator functions as a central hub and simply passes all network data between each network device in the star segment. Typically, the concentrator supports 8 to 12 network devices and may be linked to other concentrators to form larger networks.

Node

Each network device or node is assigned an address number and requires a transceiver to interface between the network device and the network. For thick-net and thin-net cabling a transceiver and a serial drop cable connects to the main trunk. The serial drop cable is sometimes referred to as an AUI (attachment unit interface) transceiver cable. For twisted pair cabling, the transceiver to connected directly to the network device.

Segment and Branch

Some Ethernet systems are comprised of smaller, stand-alone Ethernet systems (called branches or segments) that are connected by bridges, concentrators, or repeaters. Many nodes on the Ethernet network may be serviced by one segment or branch. Each segment may support many patient monitors, central stations, and auxiliary devices.

For example, one segment may connect all the patient monitors and central stations in the ICU (Intensive Care Unit) and another may connect the monitoring system in the CCU (Critical Care Unit). Each segment could be a fully-functioning stand-alone system if they were not connected to each other. However, with a bridge or repeater to connect the ICU (one segment) with the CCU (the other segment), information can pass between any of the nodes (patient monitors and central stations) on either branch similar to a patient transfer from one unit to another.

A section is a single length of twisted pair cable with a RJ-45 connector on each end. A section goes from one twisted pair transceiver to the concentrator. A segment is comprised of all the sections of twisted pair cable connected in a star formation to one concentrator.

Repeater

A repeater is used to extend the length of cabling when the distance required exceeds the length of the cable specifications. It is simply a transceiver that passes all network data between any two segments. Note that the repeater passes all network data between the two segments, regardless of whether or not the one node is sending data to another node on the same segment.

Bridge

A bridge is more selective than a repeater with the data that it passes between segments. It also acts as a transceiver between two segments, but it only passes signals if a node on one of the segments is attempting to communicate with a node on the other segment. Since the majority of communication on the network occurs within a single segment, the bridge does not pass all of the data from one segment to the other. This lowers the amount of data traffic passing between segments, and makes the network more efficient than a system that is connected with repeaters.

Twisted Pair Cabling (10BaseT)

Twisted pair is an IEEE 802.3 local area network that uses flat and small diameter cable containing four pairs of twisted wires to connect devices. Twisted pair operates at the same speed as thin-net and thick-net (10 megabits/second), but the cable distances extended up to 100 meters (328 feet).

A twisted pair transceiver passes data back and forth between the network device and the LAN. It is attached directly to the network device at the at the 15-pin D-type connector. The twisted pair cable is connected from the RJ-45 connector at the transceiver and the RJ-45 connector at the concentrator.

NOTE

> Some devices (like Octacomm/Solar 8000M patient monitor) have 10BaseT standard, meaning that the RJ-45 connector is part of the product and the twisted pair transceiver is not required.

Symbol PC Card (Wireless LAN)

The Symbol PC card, installed in the monitor, uses a 2.4 GHz frequency band and a Frequency Hopping spread spectrum (FHSS). The Frequency Hopping spread spectrum meets IEEE 802.11 standards.

Two diversity antennas, installed in the handle of the monitor, radiates the RF energy through the air to a Symbol Access Point. The Symbol Access Point also uses a 2.4 GHz frequency band and the Frequency Hopping spread spectrum.

NOTE

> Refer to the Wireless LAN (Symbol Access Point) Installation and Service Manual for detailed information on the Symbol Access point.

NOTE

> The following is required for the monitor to roam from access point to access point while maintaining Wireless LAN communication with the Unity Network.
>
> - Installation of the RF LAN (Wireless LAN) option.
> - Configuration and verification of the monitor’s RF LAN operation.
> - Activation of the RF LAN by disconnecting the monitor’s Ethernet cable.

4 Maintenance

For your notes

Maintenance Schedule

Manufacturer Recommendations

WARNING
Failure on the part of all responsible individuals, hospitals or institutions, employing the use of this device, to implement the recommended maintenance schedule may cause equipment failure and possible health hazards. The manufacturer does not, in any manner, assume the responsibility for performing the recommended maintenance schedule, unless an Equipment Maintenance Agreement exists. The sole responsibility rests with the individuals, hospitals, or institutions utilizing the device.

To ensure the monitor is always functional when required, qualified service personnel should perform the following regular maintenance.

- Visual Inspection—Perform a visual inspection upon receipt of the equipment, every 12 months thereafter, and prior to servicing the unit.
- Cleaning—Clean the unit upon receipt of the equipment, every 12 months thereafter, and each time the unit is serviced.
- Conditioning the Batteries—Condition the batteries once every six months or as needed.
- Calibrating the NBP, Analog Output BP, and Output ECG—Calibrate the NBP software upon receipt of the equipment, every 12 months thereafter, and each time the unit is opened for service. Calibrate the analog output BP and analog output ECG whenever these do NOT pass the analog output checkout procedure.
- Calibrating the Mainstream End-tidal CO_2—Calibrate upon receipt of the equipment, every 12 months thereafter, and each time the adapter is removed or replaced. Refer to the CO_2 chapter of the Dash 3000/4000 Patient Monitor Operator’s Manual.
- Calibrating the Sidestream End-tidal CO_2— Refer to the documentation that came with the CO_2 module.
- Electrical Safety Tests—Perform safety tests upon receipt of the equipment, every 12 months thereafter, and each time the unit is serviced.
- Checkout Procedures—Perform the checkout procedures upon receipt of the equipment, every 12 months thereafter, and each time the unit is serviced.
- Clearing the Stored Patient Data Memory—Admit and discharge a test patient every 12 months to clear the monitor’s stored patient data memory.

Visual Inspection

The monitor and its components should be carefully inspected prior to installation, once every 12 months thereafter and each time the equipment is serviced.

- Carefully inspect the equipment for physical damage to the case, the display screen, and the keypad. Do not use the monitor if damage is determined. Refer damaged equipment to qualified service personnel.
- Inspect all external connections for loose connectors or frayed cables. Have any damaged connectors or cables replaced by qualified service personnel.
- Inspect the display face for marks, scratches, or other damage. Physical damage to a flat panel display glass may pose an implosion hazard. Have the flat panel display replaced by qualified service personnel if necessary.
- Safety labels and inscription on the device are clearly legible.

Cleaning

Cleaning Precautions

Use one of the following approved solutions:

- Cidex solution, or
- Sodium hypochlorite bleach (diluted), or
- Mild soap (diluted)
- Lint-free cloth
- Dust Remover (compressed air)

To avoid damage to the equipment surfaces, *never* use the following cleaning agents:

- organic solvents,
- ammonia-based solutions,
- acetone solution,
- alcohol-based cleaning agents,
- Betadine solution,
- a wax containing a cleaning substance, or
- abrasive cleaning agents.

Cleaning the Display

Use a soft, clean, lint-free cloth dampened with a glass cleaner to clean the display.

CAUTION
To avoid getting liquid into connector openings, do not spray glass cleaning or general cleaning solutions directly onto the product’s surface.

Exterior Cleaning

Clean the exterior surfaces with a clean, lint-free cloth and one of the cleaning solutions listed in the table above.

- Wring the excess solution from the cloth. Do not drip any liquid into open vents, switches, plugs, or connectors.
- Dry the surfaces with a clean lint-free cloth.

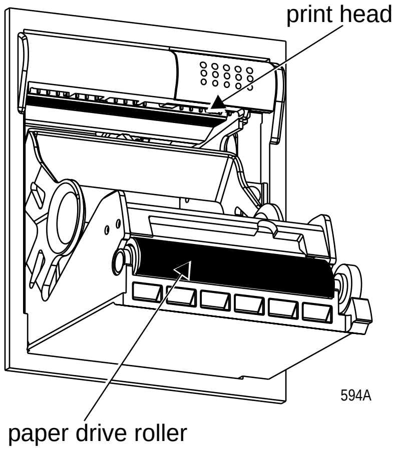
Cleaning the Print Head

Heavy usage causes debris to build up on the print head. This build can cause the printed images to appear distorted. It is recommended that this procedure be performed when necessary, depending on usage.

Materials Required

A nonabrasive material/cloth and isopropyl alcohol are all that are necessary to perform this procedure.

Procedure



1. Disconnect the power cord from the mains source.
2. Open the writer door to expose the print head.
3. Remove paper roll.
4. Locate print head shown in the figure above. A flashlight may help illuminate the print head for closer examination.
5. Wipe the print head with alcohol and a nonabrasive material/cotton swab in an side to side motion. Continue wiping until the cloth/swab wipes clean.
6. Wipe paper drive roller clean of any bits of paper and debris with alcohol and a nonabrasive material.

Battery Power

Introduction

The monitor is designed to operate on battery power during transport or whenever AC power is interrupted. A complete battery management system allows you to obtain maximum battery performance. Audible and visual alarms alert you when loss of power is imminent and on-screen capacity gauges indicate battery charge condition and capacity.

Depending on usage, you can get up to 3.5 hours of run time per battery for new, fully-charged batteries. Monitoring NBP, CO2 and SpO2 will drain battery power faster than other parameters. The display technology and brightness, graphing, and connection to a wireless network can also alter battery run times.

NOTE

A *"BATTERY LOW"* message at the top of the screen warns you prior to complete loss of battery power. You should replace the battery or connect the monitor to an AC power source when the message is displayed.

Exchangeable Battery Packs

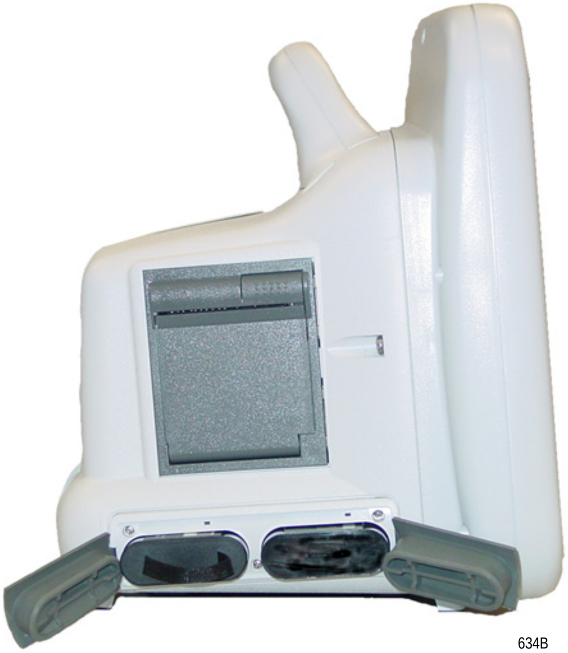
The monitor uses two exchangeable battery packs. These battery packs are a purchasable option. One battery pack can easily be exchanged while the monitor operates from the other.

CAUTION

Leaks from battery cells can occur under extreme conditions. The liquid is caustic to eyes and skin. If the liquid comes into contact with eyes or skin, flush with clean water and seek medical attention.

NOTE: For optimal performance and safety, use only batteries supplied by GE (pn 419068-005 or later).

The battery compartment is located on the lower left side of the monitor. Battery indicators let you know when the monitor is using battery power.

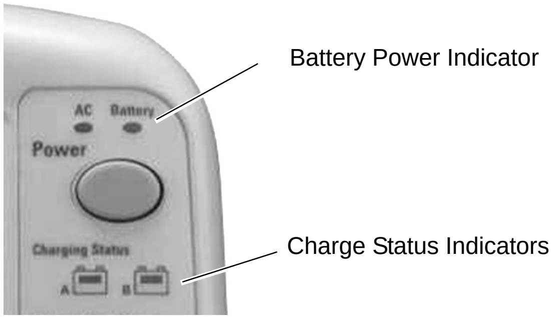


Monitor with Battery Packs

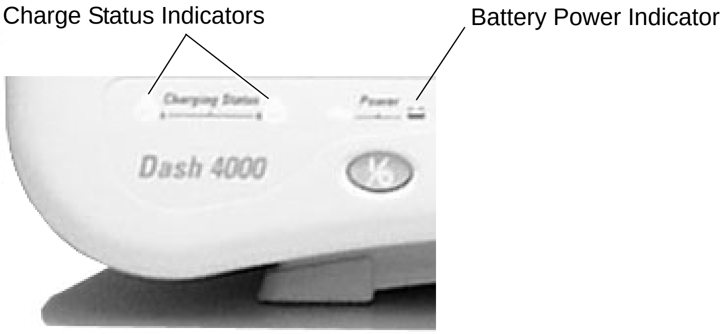
WARNING
Make sure the batteries are completely inserted and that the battery door is securely latched. Falling batteries could seriously or fatally injure a neonatal patient.

Battery Indicators

Battery indicators are located on the front panel of the monitor. They alert you to when battery power is being used and the battery charging status.


AC
Battery
Power
Charging Status
A
B
Battery Power Indicator
Charge Status Indicators

Dash 3000 Monitor’s Control Panel


Charge Status Indicators
Battery Power Indicator
Charging Status
Power
Dash 4000

Dash 4000 Monitor’s Control Panel

Battery Power Indicator

The indicator illuminates yellow when the monitor is battery powered. The indicator is not illuminated when the monitor is not powered or when AC power is applied.

Charge Status Indicators

An icon for each battery indicates its charging status. The battery icon illuminates yellow when the respective battery is being charged. If both batteries are present and require charging, then both icons will illuminate even though they will be charged sequentially. The battery icon illuminates green when the respective battery is fully charged.

When the monitor is operating under battery power the battery icons will not be illuminated. The icons are also not illuminated when the respective battery is either not being charged, not installed, or has failed.

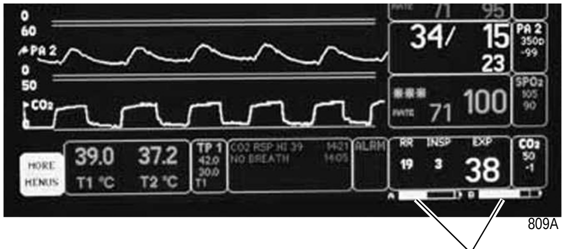
Battery Status Indicator

The battery status indicators (not shown) are located within the battery compartment. One green LED indicator is located above each of the two battery slots and will illuminate when the unit is operating on DC power from the respective battery.

Battery Capacity Gauge

On-screen capacity gauges indicate the battery's current state of health and charge status. A battery capacity gauge for each battery present is displayed below the parameter blocks in the lower right corner of the display. The capacity gauge indicates the Remaining Charge Capacity (usable energy left) for each battery.

The capacity gauges are filled in from left to right proportional with the battery charge level. The solid portion represents the Full Charge Capacity of the battery as a percentage of its Design Capacity.


0
60
PA 2
0
50
CO2
34/
15
23
PA 2
350
-99
RATE 71 95
RATE 71
100
SPO2
105
90
MORE MENUS
39.0
37.2
T1 °C
T2 °C
TP 1
42.0
30.0
T1
CO2 RSP HI 39
NO BREATH
14:21
14:05
ALRM
RR
INSP
EXP
19
3
38
CO2
50
-1
A
B
809A

Battery Capacity Gauges

Location of Battery Capacity Gauges on the Monitor

Lithium-Ion Battery

The Lithium-Ion battery is a rechargeable battery containing Lithium-Ion cells. Each battery contains an integrated electronic fuel gauge and a safety protection circuit.

The Impact of Lithium-Ion Battery Technology on the Battery

The following are the key points you should know about Lithium-Ion battery technology:

- The battery will discharge on its own, even when it is not installed in a monitor. This discharge is the result of the Lithium-Ion cells and the bias current required for the integrated electronics.
- By the nature of Lithium-Ion cells, the battery will self-discharge. The self-discharge rate doubles for every 10°C (18°F) rise in temperature.
- The capacity loss of the battery degrades significantly at higher temperatures.
- As the battery ages, the full-charge capacity of the battery will degrade and be permanently lost. As a result, the amount of charge that is stored and available for use is reduced.

How to Improve the Performance of the Battery

Installation Guideline

Position the monitor in a location that does not artificially increase the operating temperature of the battery.

- To optimize battery life and performance, choose a location that does NOT artificially increase the ambient temperature surrounding the monitor.
  - Do not place the monitor near a heat vent or near heat-generating equipment, such as computer monitors.
- Avoid placing the monitor in corners where the airflow may be restricted.

Charging Guideline

Use the Cadex SMart Two+ charger to charge the battery instead of charging the battery inside the monitor.

- The Cadex SMart Two+ charger maintains a lower battery cell temperature during the charge cycle than the monitor. This reduction in temperature will extend the life of the battery.

Conditioning Guideline

Remove the battery from the monitor every six months and condition it using the Cadex SMart Two+ charger.

- This condition cycle recalibrates the electronic fuel gauge.

Storage Guideline

Store the battery outside of the monitor at a temperature between 20°C to 25°C (68°F to 77°F).

- When the battery is stored inside a monitor that is powered by an AC power source, the battery cell temperature increases by 15°C to 20°C (59°F to 68°F) above the room's ambient temperature. This reduces the life of the battery.
- When the battery is stored inside a monitor that is continuously powered by an AC power source and is not powered by battery on a regular basis, the life of the battery may be less than 12 months. GE recommends that you remove the battery and store it near the monitor until it is needed for transport.

How to Identify the Battery Charge Capacity

Battery Capacity Definitions

The following terms are used to define the capacity of the battery:

- Design Capacity — The theoretical capacity of the battery cells when the battery is new.
- Full Charge Capacity — The actual amount of charge the battery can store and deliver to the monitor.
- Remaining Charge Capacity — The amount of Full Charge Capacity currently remaining in the battery. This is a percent of Full Charge Capacity.

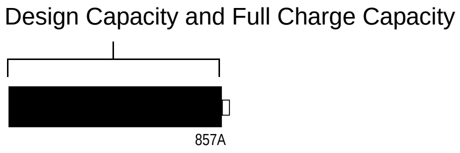
Identifying the Battery Charge Capacity Using the Monitor

One new, fully charged battery lasts about 3.5 hours. Two new, fully charged batteries last about 7 hours.

A battery that has 100% Design Capacity and is charged to 100% of this capacity lasts approximately 3.5 hours. However, as the Full Charge Capacity declines, the approximate run time of a fully charged battery will decrease.

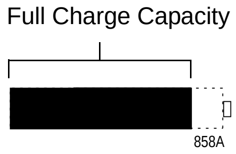
Single Battery Run Time: Approximately 3.5 Hours

An icon fully outlined with solid lines and completely filled indicates a new battery, fully charged to its Design Capacity.



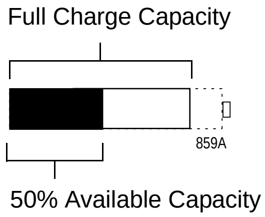
Single Battery Run Time: Approximately 2.8 Hours

The dotted portion of the icon outline shows that the battery has lost 20% of its Design Capacity. The solid-outline portion is filled in, showing that the battery is charged to 100% Full Charge Capacity.



Single Battery Run Time: Approximately 1.4 Hours

The dotted portion of the icon outline shows that the battery has lost 20% of its Design Capacity. The solid-outline portion is half filled in, showing that the battery is charged to only 50% of available capacity.



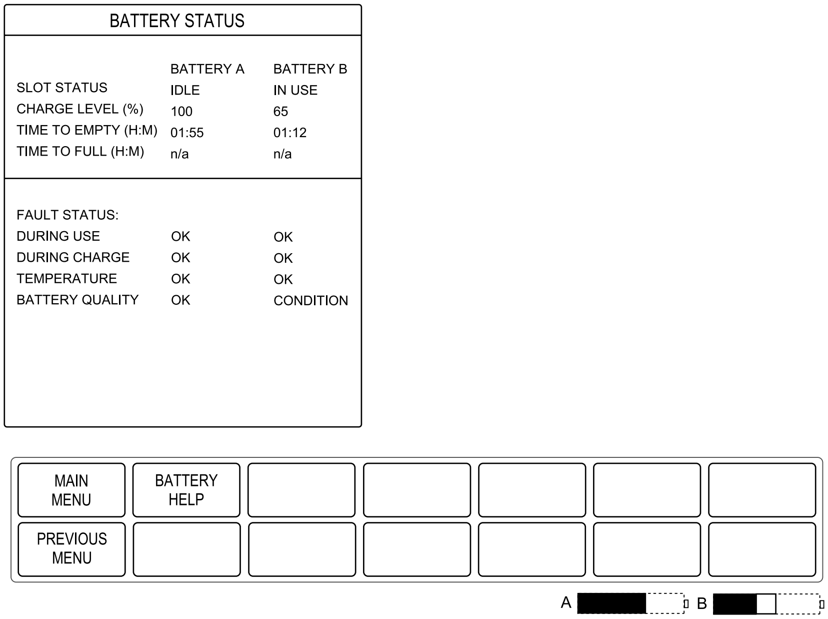
Identifying Battery Capacity Using the Cadex SMart Two+ Charger

When you select the **Target Capacity** switch on the charger, the charger compares the battery's performance to a 60%, 70%, or 80% target capacity set on the battery charger. If the battery fails to meet the target performance, the battery charger will prompt you to condition the battery. If after the condition cycle has been completed, the battery does NOT meet the target performance, then the battery charger will illuminate a "fail" light.

Identifying Battery Status Using the Battery Status Menu

This menu option opens a menu and information window that provides current battery status information.

1. Select *MORE MENUS* from the Main Menu.
2. Select *BATTERY STATUS* to display the Battery Status Menu and information window.



BATTERY STATUS

	BATTERY A	BATTERY B
SLOT STATUS	IDLE	IN USE
CHARGE LEVEL (%)	100	65
TIME TO EMPTY (H:M)	01:55	01:12
TIME TO FULL (H:M)	n/a	n/a

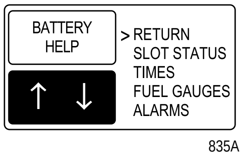
FAULT STATUS:		
DURING USE	OK	OK
DURING CHARGE	OK	OK
TEMPERATURE	OK	OK
BATTERY QUALITY	OK	CONDITION

637A

BATTERY STATUS Menu and Information Window

- If a battery is not present, a *NO BATT* message is displayed in this column.
- If the battery is *NO COMM* (communication with this battery has failed), "unknown" is displayed for all rows except the *SLOT STATUS* row.

Battery Help Menu



Each menu option opens an information window that includes the following information:

- *RETURN* — Returns to the Battery Status menu.
- *SLOT STATUS* — Provides definitions of the battery conditions.
  - *No Battery* — No battery is installed in this slot.
  - *Initializing* — Battery is just installed, establishing communication.
  - *No Comm* — Communication with this battery has failed because it is either sleeping, defective, or not a SMart Battery.
  - *Incompatible* — The battery is not compatible with this monitor's battery management system.
  - *Fail* — See message displayed in the lower half of the display.
  - *In Use* — This battery is currently powering the monitor.
  - *Full* — Fully charged.
  - *Charging* — Currently being charged.
  - *Idle* — Not currently in use or charging.

- *TIMES* — Defines "time to empty" and "time to full."
  - Time to Empty — The time to empty represents an estimate of how much longer the monitor will be able to run with the current monitored parameters. Changing the setup, running NBPs, printing graphs, etc. will likely change the value of the time remaining. This value is only displayed when the monitor is powered by battery.
  - Time to Full — The time to full represents an estimate of the time remaining before this battery is fully charged. Total recharge time for this unit is the sum of both batteries' time to full.

- *FUEL GAUGES* — Explains the battery capacity gauges.

  The fuel gauge is filled from the left to right proportional with the battery's charge level. The full rated capacity of a new battery of this type is represented by a dashed outline. The maximum charge level for the battery currently installed is represented by a solid outline. As a battery ages, its maximum charge level becomes a smaller percentage of its Design Capacity. The solid portion represents the current charge level of the battery as a percentage of its maximum Full Charge Capacity.

- *ALARMS* — Explains low battery and battery fault alarms and messages.
  - Fault Status Messages — General, charging, and temperature failures indicate that the battery has failed, or the charging of the battery has failed. Replace it with a different battery.
  - Condition — Condition this battery using an external battery charger.
  - Low Battery Alarms — The monitor will issue a System Warning alarm when there is approximately 10 minutes per battery run time remaining. The monitor will issue a System Warning alarm when shutdown is imminent (less than one minute left of remaining run time).

Battery Maintenance

How to Charge the Battery

The battery can be charged by one of two methods:

- Outside of a monitor by using the Cadex SMart Two+ charger.
- Inside a monitor that is connected to an AC power source.

NOTE

To extend the life of the battery, GE recommends that you charge the battery using the external Cadex SMart Two+ charger.

Charging the Battery With a Cadex SMart Two+ Charger

1. Insert the battery into the battery charger. The **RUN** LED illuminates.
2. Leave the battery in the battery charger until the **READY** LED illuminates.

NOTE

If the **FAIL** LED illuminates, remove the battery from the battery charger and reinsert it. This should correct any battery charger time out errors. However, if this does not correct the battery charger time out errors, then the battery is defective and should be replaced.

Charging the Battery Inside a Monitor

The battery is charged whenever the monitor is connected to an AC power source.

When you store the battery inside of a monitor that is connected to an AC power source (a state known as “floating”), the battery will self-discharge to less than 90% of its Full Charge Capacity after approximately two weeks (depending upon the temperature of the battery). At this time, the monitor will automatically recharge the battery to 100% of its Full Charge Capacity.

How to Condition the Battery

The battery can be conditioned by one of two methods:

- Outside of a monitor by using the Cadex SMart Two+ charger.
- Inside a monitor that is connected to an AC power source.

NOTE

To extend the life of the battery, GE recommends that you condition the battery using the external Cadex SMart Two+ charger.

Conditioning the Battery With a Cadex SMart Two+ Charger

A conditioning cycle using the battery charger requires approximately nine hours to complete. Complete the following steps to automatically condition the battery.

1. Insert the battery into the battery charger.
2. Press the **CONDITION** button when one of the following conditions occur:
   - While the **RUN** LED light is still flashing.
   - While the **CONDITION** LED is flashing.
3. Remove the battery from the battery charger when the **RUN** LED illuminates. This completes the conditioning cycle.

Conditioning the Battery Inside a Monitor

WARNING
PATIENT RISK HAZARD — Never condition a battery while the monitor is connected to a patient. Serious injury or death could result.

Complete the following steps to manually condition the battery using the monitor:

1. Remove all batteries from the monitor.
2. Insert one battery into Slot A of the monitor.
3. Disconnect the monitor from the AC power source.
4. Access the monitor’s Battery Status window to monitor the battery’s Charge Level. See “Identifying Battery Status Using the Battery Status Menu” on page 4-14.
5. Allow the battery to discharge to less than a 90% Charge Level.
6. Re-connect the monitor to the AC power source and fully charge the battery.
7. Disconnect the monitor from the AC power source and allow the monitor to run until it displays the *BATTERY LOW* message, or until the monitor shuts down.
8. Re-connect the monitor to the AC power source. Allow the battery to fully charge to complete the conditioning cycle.

How to Store the Battery

See “Storage Guideline” on page 4-12.

How to Wake Up the Battery

When the battery is stored for a long period of time without being charged, it will eventually lose all of its charge and “fall asleep.” When the battery is “asleep,” none of the LEDs on the battery will illuminate when the battery’s on/off button is pressed. You must “wake up” the battery before you can use it again.

There are two methods to wake up the battery:

- Outside of a monitor by using the Cadex SMart Two+ charger.
- Inside a monitor that is connected to an AC power source.

Waking Up the Battery With a Cadex SMart Two+ Charger

NOTE

A deep discharged battery will require you to repeat the following steps more than once before the battery will “wake up.”

1. Insert the battery into the battery charger and wait for the **RUN** LED light to illuminate (approximately three minutes).
2. If the **RUN** LED light does NOT illuminate, complete the following steps:
    a. Remove the battery from the battery charger.
    b. Re-insert the battery into the battery charger and let the battery trickle charge for two to three minutes while the **FAIL** LED flashes. (If the **RUN** LED light illuminates, ignore it.)
    c. Watch the battery charger LEDs and immediately remove the battery from the battery charger when the **FAIL** LED stops flashing AND remains illuminated, OR when both the **RUN** and **CONDITION** LEDs flash.
    d. Wait for one to two seconds, then re-insert the battery into the battery charger. The **RUN** and **CONDITION** LEDs will flash for five to ten seconds while the charger initializes the battery. If the **FAIL** LED illuminates, remove the battery and re-insert it into the battery charger.
    e. Watch the battery charger LEDs. The **RUN** LED should stop flashing and remain illuminated for approximately one minute later the **CONDITION** LED should stop flashing. At this time, the battery is awake and being charged.

Waking Up the Battery With a Monitor

1. Connect the monitor to an AC power source.
2. Activate the Boot Loader program.
   a. Hold down **NBP GO/STOP** and **ZERO ALL** (**FUNCTION**).
   b. Press and release the **Trim Knob** control.
   c. Keep holding **NBP GO/STOP** and **ZERO ALL** (**FUNCTION**) until the Boot Code information appears on the display.
3. Select *Wake Up Battery* from the Service Menu.
4. Insert the "sleeping" battery into slot **A** of the monitor.

   NOTE

   In some languages, slot **A** is identified as slot **1** and slot **B** is identified as slot **2**.

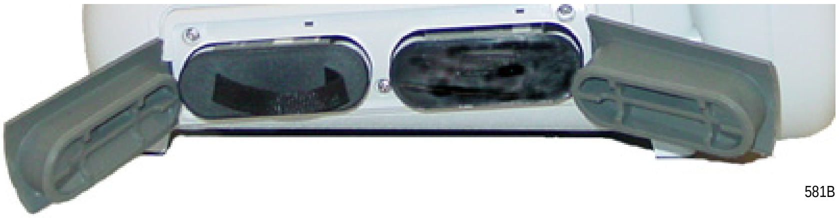
5. Select *Wake Up Lithium Ion Battery in SLOT A*. Then, the monitor applies a "wake-up" shot of current for up to 210 seconds.
6. Watch for the message, *Battery awake, run main code to charge*. The battery should now be "awake."
   - If the *"Battery awake, run main code to charge*" message appears but the battery is NOT awake, the battery may be in a deep discharge state. You should repeat step 5 at least four more times to give the battery additional "wake-up" shots of current.
7. Quickly reboot (or power cycle) the monitor to begin charging the batteries. The monitor's illuminated yellow-colored **CHARGING STATUS** LED indicates that the battery is being charged.

   NOTE

   The monitor will not charge the battery while it is running the Boot Loader program.

How to Replace the Batteries

1. Open the battery doors on the left side of the monitor, along the bottom.
2. Remove the faulty batteries.



3. Replace with a new battery. The monitor supports up to two exchangeable lithium-ion batteries. Install the battery with the connection pins facing down and inserted first.
4. Close the battery covers.
5. Verify that the monitor operates correctly.
   a. Confirm that the Battery IDs with a battery icon displays in the lower right corner of the monitor.
   b. Verify that the Battery LEDS illuminate either green or amber.

How to Recycle the Battery

When the battery no longer holds a charge, it should be replaced. The battery is recycleable. Remove the old battery from the monitor and follow your local recycling guidelines.

WARNING
EXPLOSION HAZARD — DO NOT incinerate the battery or store at high temperatures. Serious injury or death could result.

Rechargeable Battery Collection Sites

In the United States and Canada, the Rechargeable Battery Recycling Corporation (RBRC) can help you locate your nearest rechargeable battery collection site. You can contact RBRC by telephone or by accessing their internet web site.

- telephone: 1-800-8-BATTERY (800-822-8839)
- internet address: www.rbrc.org

The Cadex SMart Two+ Charger

Battery Charger LED Indicators

The following is a quick guide which identifies the meaning of the charger LEDs.

LED Indicators	Illuminated	Flashing
RUN	Charging in progress.	Initializing the battery.
RUN and CONDITION	Conditioning in progress.	
READY	Charging is complete.	
READY and CONDITION	Conditioning is complete — pass target.	Conditioning is required.
FAIL	Battery fault.	Charger fault.
FAIL and CONDITION	Conditioning is complete — fail target.	

Equipment Software Requirements

- The monitor must use Dash 3000/4000 software version 2A or later.
- The Cadex SMart Two+ Charger must use software version 1.1 or later.

Electrical Safety Tests

General

Electrical safety tests provide a method of determining if potential electrical health hazards to the patient or operator of the device exist.

Recommendations

GE recommends that you perform all safety tests presented in this chapter.

- upon receipt of the device (monitor and its associated equipment),
- every twelve months thereafter,
- each time the main enclosure is disassembled or a circuit board is removed, tested, repaired, or replaced, and
- record the date and results on the “Maintenance/Repair Log” included at the end of this chapter.

These instructions are intended for every component in the system. If the Tram-rac housing does not have its own power supply, it should remain connected to the monitor throughout the safety tests.

WARNING
Failure to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards. Unless you have an Equipment Maintenance Contract, GE does not in any manner assume the responsibility for performing the recommended maintenance procedures. The sole responsibility rests with the individual or institution using the equipment. GE service personnel may, at their discretion, follow the procedures provided in this manual as a guide during visits to the equipment site.

Test Conditions

Electrical safety tests may be performed under normal ambient conditions of temperature, humidity, and pressure.

Test Equipment

The recommended test equipment required to perform electrical safety tests is listed below.

Item	Specification
Leakage Current Tester	Equivalent to the circuits shown
Digital Multimeter (DMM)	AC volts, ohms
Ground Bond Tester	0 – 1 ohm
ECG Test Body	All leads together
Masimo SET SPO2 Test Body	2006036-001
GE and Nellcor SPO2 Test Body	2006646-001

Power Outlet Test

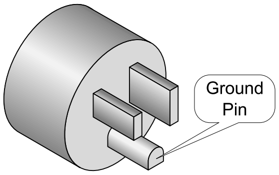
Before starting the tests, the power outlet from which the monitoring device will get electrical power must be checked. This test checks the condition of the power outlet to ensure correct results from leakage tests.

For international power outlets, refer to the internal standards agencies of that particular country. Use a digital multimeter to ensure the power outlet is wired properly.

If other than normal polarity and ground is indicated, corrective action must be taken before proceeding. The results of the following tests will be meaningless unless a properly wired power outlet is used.

Ground (Earth) Integrity

Listed below are two methods for checking the ground (earth) integrity, “Ground Continuity Test” and “Impedance of Protective Earth Connection.” These tests determine whether the device's exposed metal and power inlet's earth (ground) connection has a power ground fault condition.



Perform the test method below that is required by your Country/Local governing safety organization.

Ground Continuity Test

Completion of this test is checked by the following steps:

1. Disconnect the device under test from the power outlet.
2. Connect the negative (-) lead of the DMM to the protective earth terminal (ground pin in power inlet connector) or the protective earth pin in the Mains plug (ground pin in power cord). Refer to the US 120Vac power cord figure above.
3. Set the DMM to the milliohm (mΩ) range.
4. Connect the positive (+) lead of the DMM to all exposed metal surfaces on the device under test. If the metal surfaces are anodized or painted, scrape off a small area in a inconspicuous place for the probe to make contact with the metal.
5. Resistance must read:
    - 0.1 ohm or less without power cord
    - 0.2 ohms or less with power cord

Impedance of Protective Earth Connection

This test unlike a ground continuity test will also stress the ground system by using special ground bond testers.

This test normally is only required as a manufacturing production test to receive safety agency compliance (i.e. IEC601-1).

Some country agency's do require this test after field equipment repairs (i.e. Germany's DIN VDE 0751 standards).

Consult your country/local safety agency if in question.

Compliance is checked by the following steps:

1. A current not less than 10A and not exceeding 25A from a current source with a frequency of 50 or 60 Hz with a no-load voltage not exceeding 6 V is passed for at least 5 s through the protective earth terminal or the protective earth pin in the mains plug and each accessible metal part which could become live in case of failure in basic insulation.
2. The voltage drop between the parts described is measured and the impedance determined from the current and voltage drop. It shall not exceed the values indicated.

For equipment without a power supply cord the impedance between the protective earth terminal and any accessible metal part which is protectively earthed shall not exceed 0.1 ohms

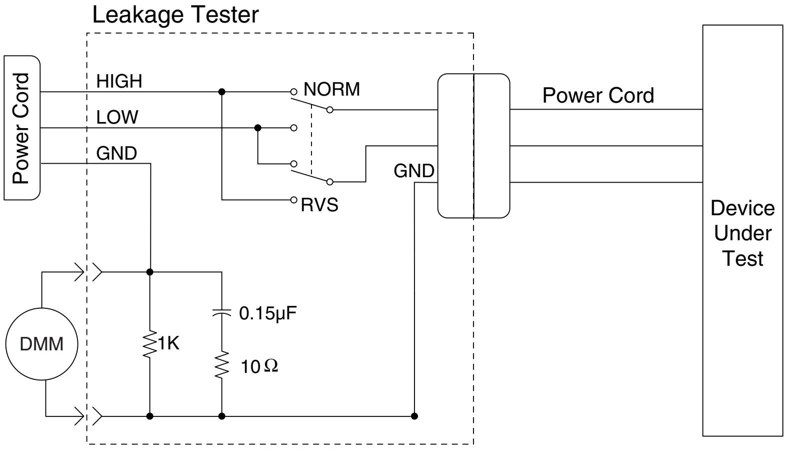
For equipment with a power supply cord the impedance between the protective earth pin in the mains plug and any accessible metal part which is protectively earthed shall not exceed 0.2 ohms.

When taking this measurement, move the unit's power cord around. There should be no fluctuations in resistance.

Ground (Earth) Wire Leakage Current Tests

Perform this test to measure current leakage through the ground (earth) wire of the equipment during normal operation.

1. Configure the leakage tester like the circuit shown below.



DMM set to measure AC voltage

2. Connect the power cord of the device under test to the power receptacle on the leakage tester.
3. The device under test is to be tested at its normal operating voltage.
4. Set the power switch of the device under test to ON.
5. Read the current leakage indicated on DMM.
6. Set the polarity switch on the leakage tester to RVS (reverse).
7. Read the current leakage indicated on DMM.

   NOTE

   If either reading is greater than the appropriate specification below, the device under test fails. Contact GE Medical Systems *Information Technologies* Technical Support.

   - 300 µA (0.3 volts on the DMM), and the device under test is powered from 100-120 V/50-60 Hz
   - 300 µA (0.3 volts on the DMM), and the device under test is powered from a centered-tapped 200-240 V/50-60 Hz, single phase circuit
   - 500 µA (0.5 volts on the DMM), and the device under test is powered from a non-center-tapped, 200-240 V/50-60 Hz, single-phase circuit

     NOTE

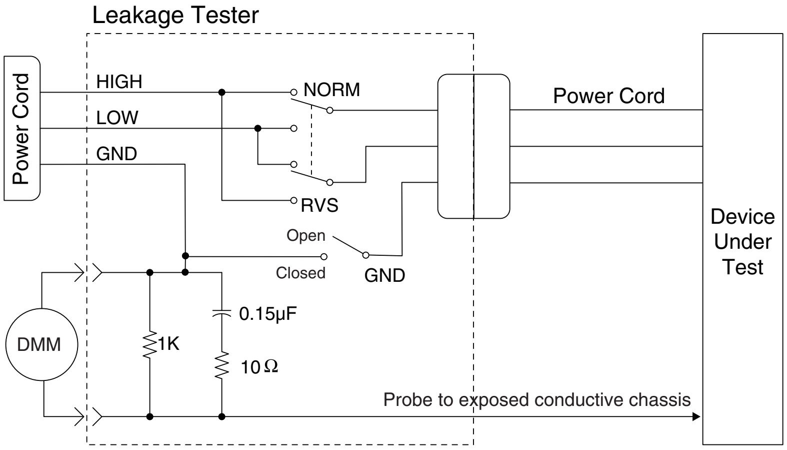
     Center-tapped and non-center-tapped supply circuits produce different leakage currents and the UL and IEC limits are different.

8. Set the power switch of the device under test to OFF.

Enclosure Leakage Current Test

Perform this test to measure current leakage through exposed conductive surfaces on the device under test during normal operation.

1. Configure the leakage tester like the circuit shown below with GND switch OPEN and polarity switch NORM.



DMM set to measure AC voltage

2. Connect probe to an unpainted, non-anodized chassis ground on the unit under test (Equipotential lug).
3. Set the power switch of the device to ON.
4. Read the current leakage indicated on DMM.

   NOTE

   Center-tapped and non-center-tapped supply circuits produce different leakage currents and the UL and IEC limits are different.

5. Set the polarity switch to RVS.
6. Read the current leakage indicated on DMM.

   NOTE

   If either reading is greater than the appropriate specification below, the device under test fails. Contact GE Medical Systems *Information Technologies* Technical Support.

   - 300 µA (0.3 volts on the DMM), and the device under test is powered from 100-120 V/50-60 Hz
   - 300 µA (0.3 volts on the DMM), and the device under test is powered from a centered-tapped 200-240 V/50-60 Hz, single phase circuit
   - 500 µA (0.5 volts on the DMM), and the device under test is powered from a non-center-tapped, 200-240 V/50-60 Hz, single-phase circuit

7. Set the GND switch on the leakage tester to CLOSED.
8. Read the current leakage indicated on DMM.
9. Set the polarity switch to RVS.

10. Read the current leakage indicated on DMM.

NOTE

If the reading is greater than the specification below, and the device under test is powered from 100-240 V/50-60 Hz, the device under test fails. Contact GE Medical Systems *Information Technologies* Technical Support.

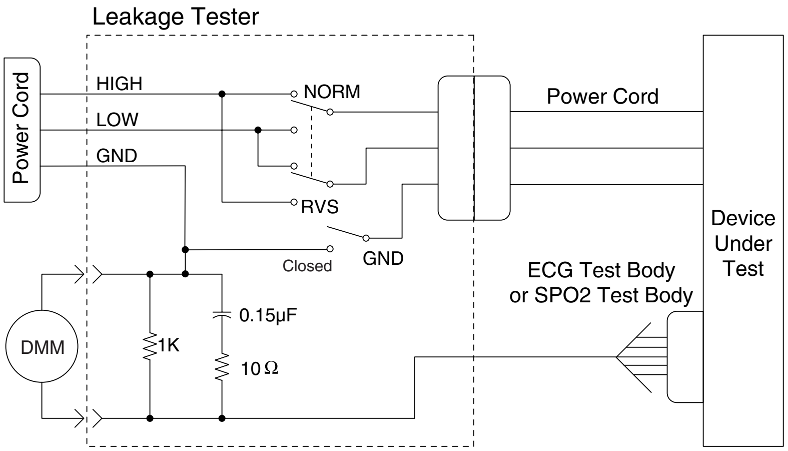
◆ 100 microamperes (0.1 volts on the DMM), and the device under test is powered from 100-240 V/50-60 Hz

11. Set the power switch of the device under test to OFF.

Patient (Source) Leakage Current Test

This procedure only applies to Class I (grounded/earthed) equipment, and measures the leakage current from the ECG/RESP connector or the SPO2 connector of the device to ground.

1. Configure the leakage tester like the circuit shown below with GND switch OPEN and polarity switch NORM.



DMM set to measure AC voltage

2. Connect an ECG test body to the ECG/RESP connector of the device under test.
3. Set the power switch of the device to ON.
4. Read the leakage current indicated on the DMM.
5. Change the leakage tester polarity switch to the RVS position.
6. Read the leakage current indicated on the DMM.

NOTE

If either reading is greater than 50 µA (0.05 volts on the DMM), the device fails this test. Contact GE Medical Systems *Information Technologies* Technical Support.

7. Change the GND switch to the Closed position.
8. Read the leakage current indicated on the DMM.
9. Change the leakage current switch to the RVS position.
10. Read the leakage current indicated on the DMM.

    NOTE

    If either reading is greater than 10 µA (0.01 volts on the DMM), the device fails this test. Contact GE Technical Support.

11. Set the power switch of the device to OFF.

    NOTE

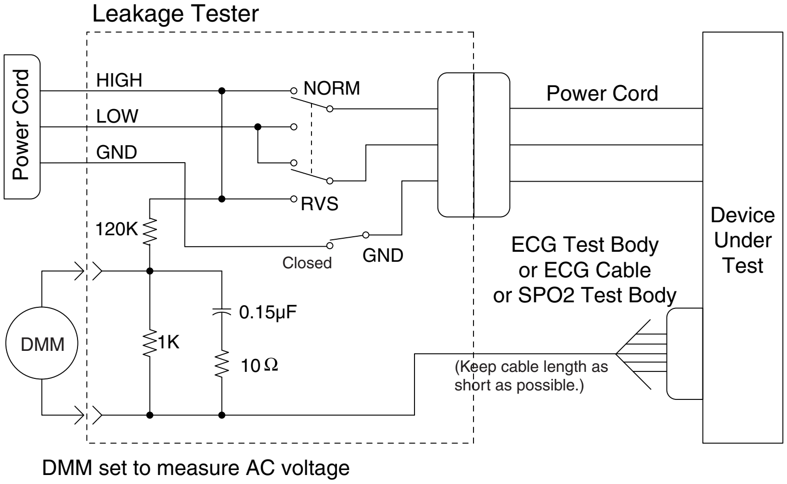
    The AAMI and IEC single fault condition (ground open) is 50 µA, whereas the normal condition (ground closed) is less.

12. Repeat the steps in this procedure using the appropriate GE or Masimo SET SPO2 Test Body. Connect the SPO2 Test Body to the blue SPO2 connector of the device under test.

Patient (Sink) Leakage Current Test (Mains Voltage on the Applied Part)

This procedure only applies to Class I (grounded/earthed) equipment, and measures the leakage current from a mains voltage source into the ECG/RESP connector.

1. Configure the leakage tester like the circuit shown below with GND switch CLOSED and polarity switch NORM.


Leakage Tester
Power Cord
HIGH
LOW
GND
NORM
RVS
Power Cord
120K
Closed
GND
ECG Test Body
or ECG Cable
or SPO2 Test Body
Device
Under
Test
DMM
0.15µF
1K
10 Ω
(Keep cable length as
short as possible.)
DMM set to measure AC voltage

WARNING

Shock hazard. The following step causes high voltage at the test body. Do not touch the test body.

2. Set power switch on the device to ON.
3. Read leakage current indicated on DMM.

4. Change the leakage tester polarity switch to the RVS position.
5. Read the leakage current indicated on the DMM.

NOTE

> If either reading is greater than the appropriate specification below, the device under test fails. Contact GE Medical Systems *Information Technologies* Technical Support.

- 10 µA (0.01 volts on the DMM) at 120 VAC using the test body.
- 20 µA (0.02 volts on the DMM) at 240 VAC using the test body.
- 50 µA (0.05 volts on the DMM) at 120-240 VAC using the ECG cable.

  NOTE

  > The 10 and 20 µA limits are based on internal design standards. The 50 µA limit is common to all standards. AAMI ES-1 standard requires using the patient cable.

1. Set the power switch on the device to OFF.
2. Repeat the steps in this procedure using the appropriate GE or Masimo SET SPO2 Test Body. Connect the SPO2 Test Body to the blue SPO2 connector of the device under test

Test Completion

1. Disconnect the leakage tester from the power outlet.
2. Disconnect all test equipment from the device.
3. Disconnect the device power cord from the leakage tester.

Checkout Procedures

Manufacturer Recommendations

These checkout procedures provide service personnel with a method to verify operational and functional performance of the monitor. Failure to attain any of the listed results indicates a potential malfunction of the monitor.

The checkout procedures are based on the assumption that the tested monitor has known good cables and test equipment. It also requires that the user be familiar with the operation of all test equipment required for the checkout procedures. For more information concerning the operation of these components, refer to the respective operator manual(s).

Frequency

GE recommends that you perform the checkout procedures:

- Upon receipt of the device.
- Every 12 months thereafter.
- Each time the main enclosure is disassembled or a circuit board is removed, tested, or replaced.

Test Equipment

The following table lists GE recommended test equipment, adaptors, and cables you need to successfully complete the checkout procedures. The checkout procedures are written for the test equipment in the following table. If you use test equipment other than those GE recommends, you may need to slightly modify some test steps.

Patient Simulators and Cables
ECG Test ■ Marq-I ECG Simulator (no longer available for ordering) ■ MarqII-KIT (includes CO injectate box) ■ MarqIII-KIT (includes CO injectate box) NOTE You can use a MarqI, MarqII, or MarqIII patient simulator or an equivalent 12SL ECG patient simulator. ■ ECG Patient Cable ■ ECG Leadwire Set
Blood Pressure Test ■ Blood Pressure Simulator Adapter Cable (700095-001) ■ Dual BP cable (PN 2005772-001)

Temperature Test

- 700/400 Series Dual Temperature Adapter (402015-004)
- Temperature Simulator Cable for use with Marq-I only (6770031)

Cardiac Output Test

- Cardiac Output Simulator II (900028-001) (no longer available for ordering)
- Cardiac Output Cable Adapter (700092-001)

Masimo Sp0$_2$ Test

- Masimo SpO2 Test Kit (2021087-001). Includes Masimo Tester and SP02 Sensor Adapter Cable.

  NOTE

  The Masimo Tester is intended for use only with Masimo instruments or instruments containing Masimo SET oximetry with standard Masimo PC Series patient cable connectors. See the Masimo “Directions for Use” that came with the Tester for more information

  The PPR and SP02 values for the Masimo Tester must be within these limits: Peripheral pulse rate: 61 bpm ± 1 bpm; and SPO2 value: 81% ± 3%.

- Clinical Dynamics’ SmartSAT^{TM} Pulse Oximetry Analyzer (or equivalent). Contact Clinical Dynamics for appropriate Nellcor or Masimo SET SpO$_2$ adapter cable. However, the simulator comes standard with a Nellcor SpO$_2$ cable.
- Fluke Biomedical’s Index 2$_{XL}$ SpO$_2$ Simulator (or equivalent). Uses either a Masimo SET or Nellcor SpO$_2$ finger probe patient cable.

GEMS-IT Sp0$_2$ Test (Nellcor Probes)

- GEMS-IT SpO$_2$ Simulator (408610-001 or equivalent).

  NOTE

  The GEMS-IT SPO$_2$ Simulator is only compatible with the GEMS-IT SPO$_2$ parameter.

- GEMS-IT SpO$_2$ Simulator Cable (700232-004 or equivalent)
- Clinical Dynamics’ SmartSAT^{TM} Pulse Oximetry Analyzer (or equivalent). Contact Clinical Dynamics for appropriate Nellcor or Masimo SET SpO$_2$ adapter cable. However, the simulator comes standard with a Nellcor SpO$_2$ cable.
- Fluke Biomedical’s Index 2$_{XL}$ SpO$_2$ Simulator (or equivalent). Uses either a Masimo SET or Nellcor SpO$_2$ finger probe patient cable.

NBP Test

- NBP Cuff Coupling (400787-001)
- NBP Hose Coupling (46100-002)
- NBP Tee (4745-101)
- NBP Tubing 2 feet (401582-001)
- Manometer: digital or mercury (Sensym PDM200M)
- NBP Tube (414873-001)
- NBP Cuff (9461-301)
- Pipe: PVC

DEFIB Sync Test

- Oscilloscope

Identify the Patient Parameter and Software Options Enabled on the Monitor

The check out procedures support all enabled patient parameter and software options. Complete the following procedure to record the options enabled on the monitor.

1. From the Main Menu, select *MORE MENUS* > *MONITOR SETUP* > *SOFTWARE CONFIGURATION*.
2. Record the software options that are enabled on the monitor.

Option	X	Comments
0BP (invasive)		No invasive BP options are enabled. As a result, no invasive blood pressure test is required.
1BP or 2BP (invasive)		Complete the "Invasive Blood Pressure Tests" on page 4-44.
3BP or 4BP (invasive)		Complete the "Invasive Blood Pressure Tests" on page 4-44. This test requires the Dual BP cable to complete the checkout procedure. See "Test Equipment" on page 4-33.
12SL Analysis		Complete the "12SL and ACI-TIPI ECG Test" on page 4-39. If 12SL is not enabled, complete the "5 Lead ECG Test" on page 4-37.
ETCO$_2$ (CO$_2$) (End-tidal CO$_2$)		Complete "End-tidal CO$_2$ Test" on page 4-54.
Network Connectivity		Complete the "Network Test" on page 4-57.

3. Complete the checkout procedures for the monitor.

Monitor Power-up Tests

NOTE

> When the monitor is connected to a docking station, use the docking station's power cable instead of the monitor's power cable.

1. Remove the batteries and unplug the monitor (or the docking station) from AC power to turn the monitor off.
2. Restore the batteries to the monitor and plug the monitor (or the docking station) into AC power to turn the monitor on.
3. Verify all of the front panel indicators illuminate on power up.
4. Verify the AC indicator on the monitor stays illuminated.

   NOTE

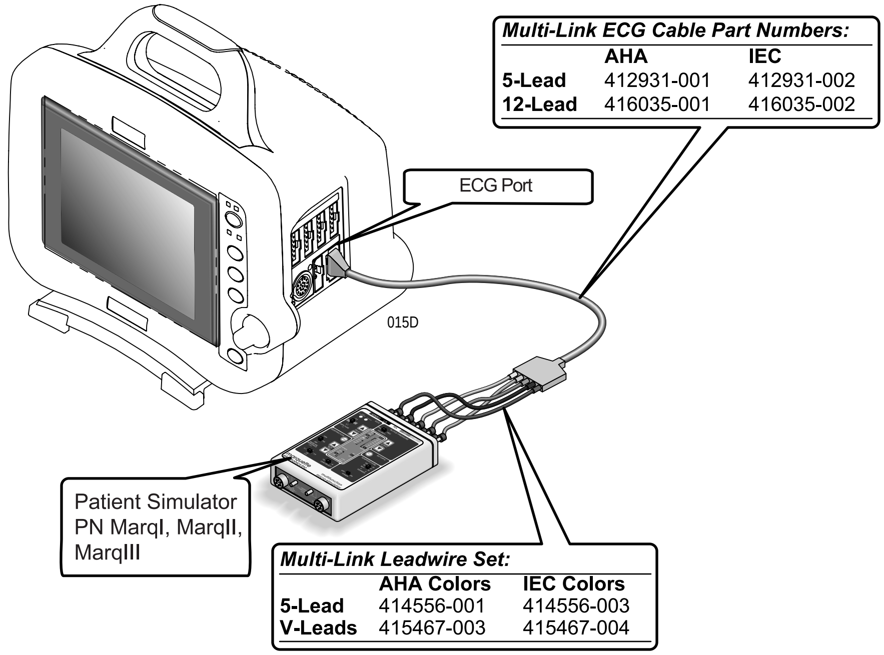
   > If the AC LED stays on, but the screen is blank, the monitor is likely in "standby mode" (battery charging). Press the **POWER** button to enter the normal mode.

   - ◆ If the AC indicator is on, continue with the tests.

- If either of the **CHARGING STATUS** indicators is yellow, wait for the battery(ies) to fully charge and the indicators to illuminate green. The batteries may take up to four hours to charge.
- If the battery "fuel gauge" displays the word "ERROR," the battery may be asleep. Refer to "Error Messages" on page 5-30.

5. Verify the optional alarm indicator lights both red and amber on power up.
6. Verify an audio "Beep" sounds at the end of Boot up.
7. Test all of the front panel keys and the **Trim Knob** control. Verify that an audio "Beep" sounds after each key press.
8. Check battery power for both batteries.
   - Unplug the monitor (or the docking station) from AC power and open the battery door. Verify one LED in the battery compartment is on (batteries must have more than 10% charge).
   - Pull that battery out and verify the other LED lights, thus indicating the unit is powered by the other battery.
   - Reinstall battery and plug in monitor (or the docking station).

ECG Tests



Multi-Link ECG Cable Part Numbers:

	AHA	**IEC**
5-Lead	412931-001	412931-002
12-Lead	416035-001	416035-002

Multi-Link Leadwire Set:

	AHA Colors	**IEC Colors**
5-Lead	414556-001	414556-003
V-Leads	415467-003	415467-004

5 Lead ECG Test

Perform this test if the monitor acquires 5 lead ECG data.

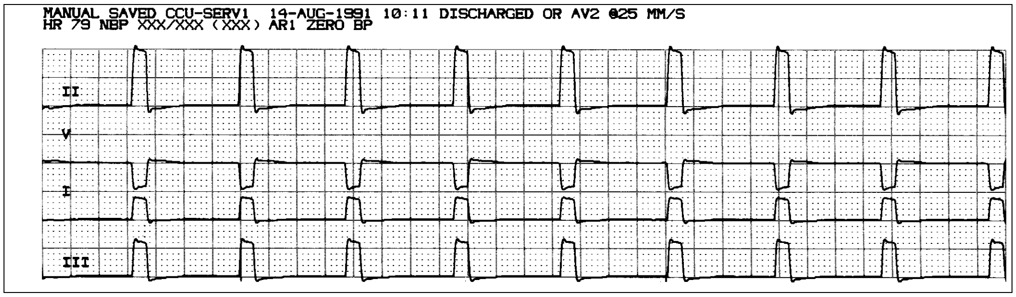
1. Set up the patient simulator as follows.
   - Heart rate – 80 bpm.
   - Heart rate amplitude – 1.0 mV.
   - 5-lead ECG patient cable properly attached.
   - 2x gain for a MarqI, MarqII, or MarqIII simulator.
2. Attach the ECG patient cable and ECG leadwire set to the **ECG/ RESP** connector on the monitor and the leadwire connectors on the top of the patient simulator.
3. Admit the patient simulator to the monitor.
4. Observe the following:
   - ECG lead II is displayed and is noise-free,
   - Heart rate of 80 ±1 bpm is displayed,
   - With QRS tones enabled, an audible tone sounds with each R-Wave (QRS complex).
5. Verify all six ECG leads are available to view and are noise-free.
6. Select *DETECT PACE* and set to *PACE 2*.
7. Select a pacemaker pulse on the simulator.

8. Observe the following while you view ECG leads I, II, III, aVL, aVF, and AVR:
   - a “P” appears above the PVC count indicating pacemaker pulse detection is enabled, and
   - the heart rate still reads 80 ±1 bpm.

9. Disable pacemaker pulse detection on the monitor and return the simulator to these conditions:
   - Heart rate – 80 bpm,
   - Heart rate amplitude – 1.0 mV,
   - 5-lead ECG patient cable properly attached.

10. Select ECG lead II to view in the top trace position on the monitor display.
11. Disconnect the RA leadwire from the patient simulator.
12. Observe that:
    - an RA FAIL message appears on the display, and
    - lead III automatically displays in place of lead II in the top trace position.

13. Reconnect the RA leadwire to the patient simulator.
14. Inject a 1-millivolt calibration signal using the patient simulator and start a manual graph.
15. Observe that the calibration pulse properly displays and graphs.



MANUAL SAVED CCU-SERV1 14-AUG-1991 10:11 DISCHARGED OR AV2 @25 MM/S
HR 79 NBP XXX/XXX (XXX) AR1 ZERO BP

016A

16. This completes the 5 Lead ECG test. Continue to the next steps of these checkout procedures.

12SL and ACI-TIPI ECG Test

Perform this test if your monitor uses the 12SL ACI-TIPI ECG option.

1. Set up the patient simulator as follows:.
   - Heart rate – 80 bpm.
   - Heart rate amplitude – 1.0 mV.
   - 12SL ECG patient cable (5-leads with V leads) properly attached.
   - 2x gain for a MarqI, MarqII, or MarqIII simulator.
2. Select *ECG* from the monitor menu. Then, select *12 LEAD ECG ANALYSIS*.
3. Verify that the monitor is displaying 10 noise-free leads.
4. Select *12LD ECG NOW*. Wait for the monitor to acquire and analyze the data.
5. Select Transmit-Print.
6. Verify the 12SL ECG prints at the graph location assigned in the monitor's Graph Setup >12SL Graph Location.
   - If there is no graph location is assigned, an error message appears on the bottom of the monitor's display.
7. Verify the ECG is transmitted to the MUSE Cardiovascular Information System. Verify the ECG prints out correctly as defined by the MUSE system.
   - If no MUSE system is connected, an error message appears on the bottom of the monitor's display.
8. Delete this test 12SL ECG from the MUSE system's edit list.

Respiration Tests

1. With the ECG patient cable still connected to the **ECG/RESP** connector of the monitor, set up the patient simulator as follows:
   - Respiration (RESP) baseline impedance – 750Ω (or 1000Ω if using Marq II or MarqIII),
   - RESP ΔR – 0.5Ω,
   - RESP lead select – I & II (or LL if using Marq II or MarqIII),
   - RESP rate (respirations per minute) – 30.

2. Set up the monitor as follows:
   - RESP waveform – on,
   - RESP waveform lead select – lead II (RESP waveform derived from ECG lead II).

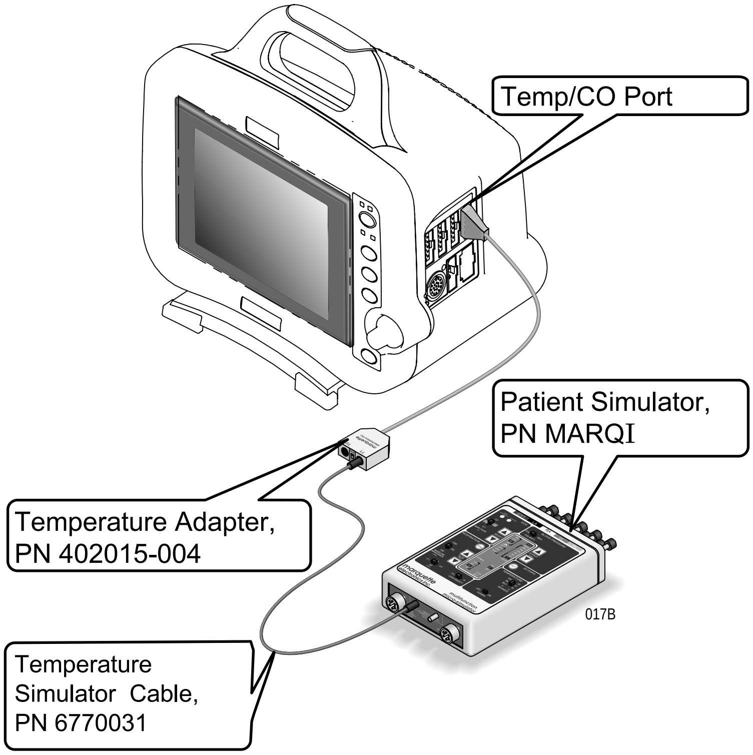
3. Observe the following:
   - RESP parameter window appears on the monitor with a reading of 30 ±2 (respirations per minute),
   - RESP waveform appears distortion-free on the monitor.

4. Change the RESP waveform lead select of the monitor to lead I (RESP waveform derived from ECG lead I), LA at the simulator.
5. Observe the following:
   - RESP parameter window appears on the monitor with a reading of 30 ±2 (respirations per minute),
   - RESP waveform appears distortion-free on the monitor.

6. Disconnect the ECG patient cable from the **ECG/RESP** connector of the monitor. Proceed to the next steps in these checkout procedures.

Temperature Tests

1. Set up the patient simulator for a temperature output of 37°C.
2. Attach the temperature adaptor cable to the **TEMP/CO** connector of the monitor.
3. Set the switch on the temperature adaptor to the 400 position.
4. Attach the temperature simulator cable from the SERIES 400 TEMPERATURE OUTPUT connector of the patient simulator to the **T1** connector of the temperature adaptor.


Temp/CO Port
Patient Simulator, PN MARQI
Temperature Adapter, PN 402015-004
Temperature Simulator Cable, PN 6770031
017B

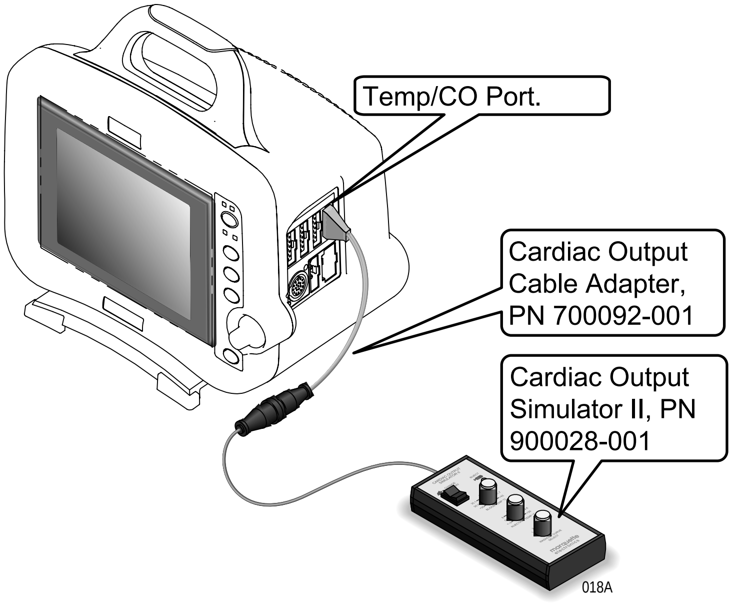
5. Verify a TEMP parameter window appears on the monitor display with a T1 reading of 37.0° ±0.4° C.
6. Move the temperature simulator cable from the **T1** connector of the temperature adaptor to the **T2** connector of the temperature adaptor.
7. Verify a T2 reading of 37.0° ±0.4° C in the TEMP parameter window on the monitor display.
8. Repeat the above procedure using 700 settings on simulator and cable.
9. Remove the temperature adaptor and temperature simulator cable from the monitor and patient simulator.

Cardiac Output Tests

Cardiac output testing is different depending on the simulator you use. The Cardiac Output Simulator II is no longer available, but if you already have that simulator, use the first section to run this test. Otherwise, go to “Test with Marq II or MarqIII Simulator.”

Test with Cardiac Output Simulator II

1. Connect the cardiac output (CO) cable adaptor to the **TEMP/CO** connector of the monitor.
2. Connect a simulator cable between the CO cable adaptor and the CO simulator.


Temp/CO Port.
Cardiac Output Cable Adapter, PN 700092-001
Cardiac Output Simulator II, PN 900028-001
018A

3. Set the CO simulator to output blood temperature (BT) readings, as found in the following table:

Simulator BT Setting	Monitor BT Reading Range
30.3°C	30.1 – 30.5
35.1°C	34.9 – 35.3
36.0°C	35.8 – 36.2
37.0°C	36.8 – 37.2
41.7°C	41.5 – 41.9

4. Verify a CO parameter window appears on the monitor display with correct BT readings as shown in the table above.

5. Set the CO simulator to output injectate temperature (IT) readings, as found in the following table:

Simulator IT Setting	Monitor IT Reading Range
0.0°C	–0.3 – +0.3
8.0°C	7.7 – 8.3
15.0°C	14.7 – 15.3
24.0°C	23.7 – 24.3
29.6°C	29.3 – 29.9

6. Verify correct IT readings appear on the monitor display, as shown in the table above.
7. Disconnect the CO cable adaptor from the **TEMP/CO** connector of the monitor. This completes the CO tests.

Test with Marq II or Marq III Simulator

1. Connect the cardiac output cable adapter to the **TEMP/CO** connector of the Tram module.
2. Connect the cardiac output adapter to the cardiac output cable adapter and to the Marq II or to the MarqIII simulator.
3. At the monitor, select *MORE MENUS* >*CO*.
4. Set up the monitor:
   a. Set *AUTO MODE:* to *ON*
   b. Set *INJECT TEMP:* to *BATH*
   c. Set *SIZE:* to *7*
   d. Set *INJECT VOL:* to *10CC*
   e. Set *COMPUTATIONAL CONSTANT:* to *0.540*
5. Set the adapter to **0°**.
6. Turn the simulator ON. Select cardiac output menu corresponding to the injectate temperature. (i.e. menu #92 for 0°, or #95 for 24°)
7. When the monitor screen displays the message, *INJECT WHEN READY*, press **Enter** on the simulator.
8. When computing is complete, the CO reading should be approximately 37°C at 5 liters of blood per minute ± 5%.
9. Repeat this test with the adapter set to **24°** and the *COMPUTATIONAL CONSTANT:* set to 0.595.
10. The output should be the same.

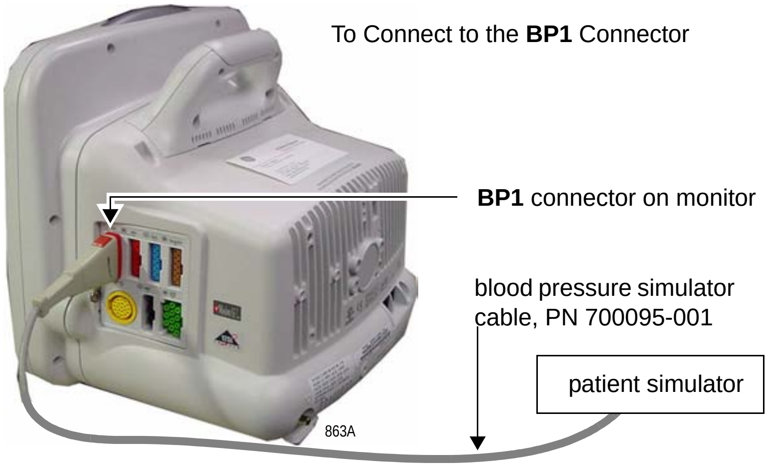
Invasive Blood Pressure Tests

The invasive blood pressure (BP) tests provide a method of verification for both BP connectors (**BP1, BP2**, **BP1/3** and **BP2/4**) of a monitor equipped with this optional function. Follow these steps:

1. Set up the patient simulator as follows:
   - Blood pressure (BP) polarity – POS, if required.
   - BP output – 0 mmHg.
   - BP transducer output – 5 µVolts.

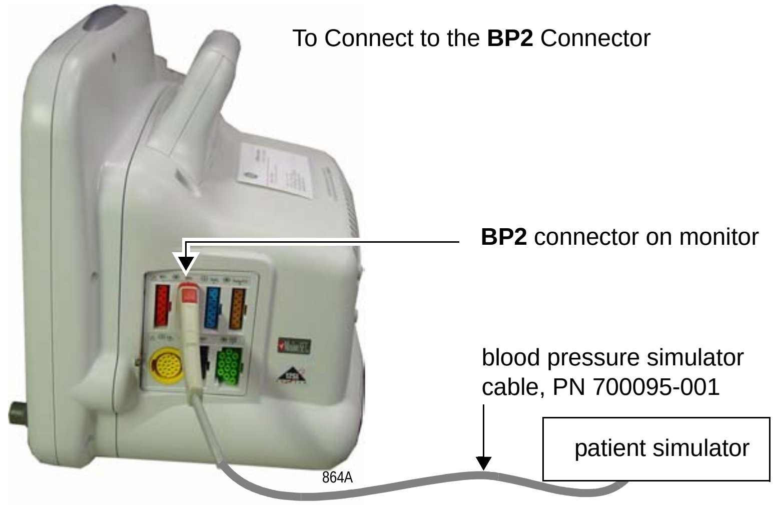
BP Connector Tests

1. Connect the BP simulator cable from the BLOOD PRESSURE 1 - 120/80 connector of the patient simulator to the enabled **BP** connectors you will be testing on the monitor.
   a. To connect to the **BP1** or the **BP2** connector, see the pictures below.



To Connect to the **BP1** Connector

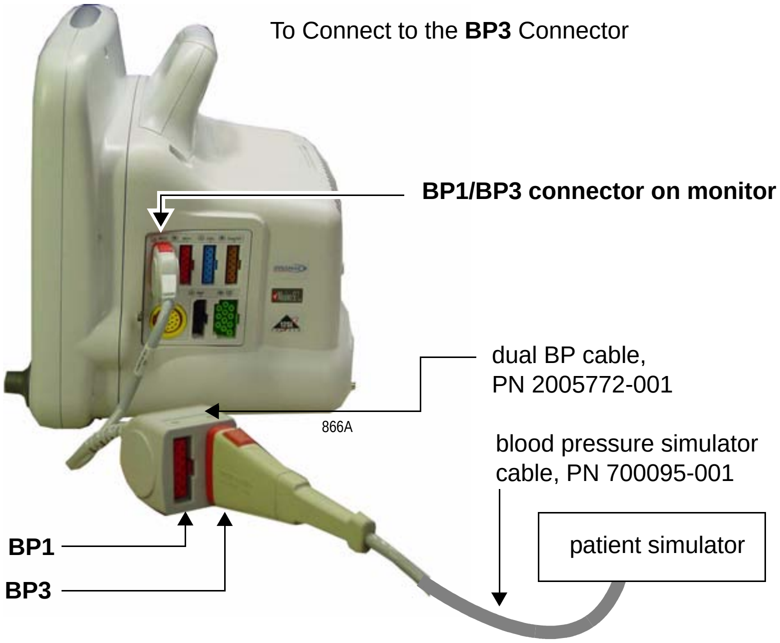
BP1 connector on monitor
blood pressure simulator cable, PN 700095-001
patient simulator
863A

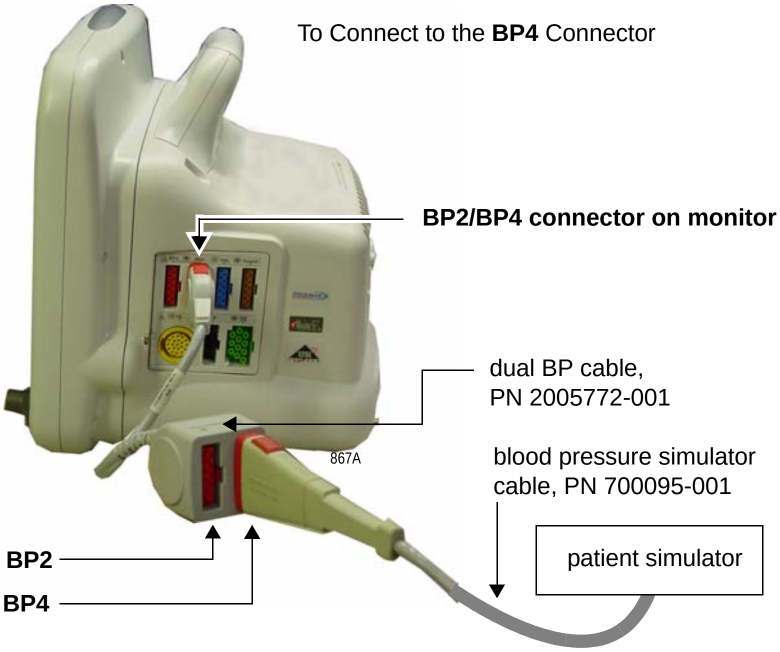


To Connect to the **BP2** Connector

BP2 connector on monitor
blood pressure simulator cable, PN 700095-001
patient simulator
864A

b. To connect to the **BP3** or **BP4** connectors, see the pictures below.


To Connect to the **BP3** Connector
BP1/BP3 connector on monitor
dual BP cable,
PN 2005772-001
866A
blood pressure simulator
cable, PN 700095-001
patient simulator
BP1
BP3

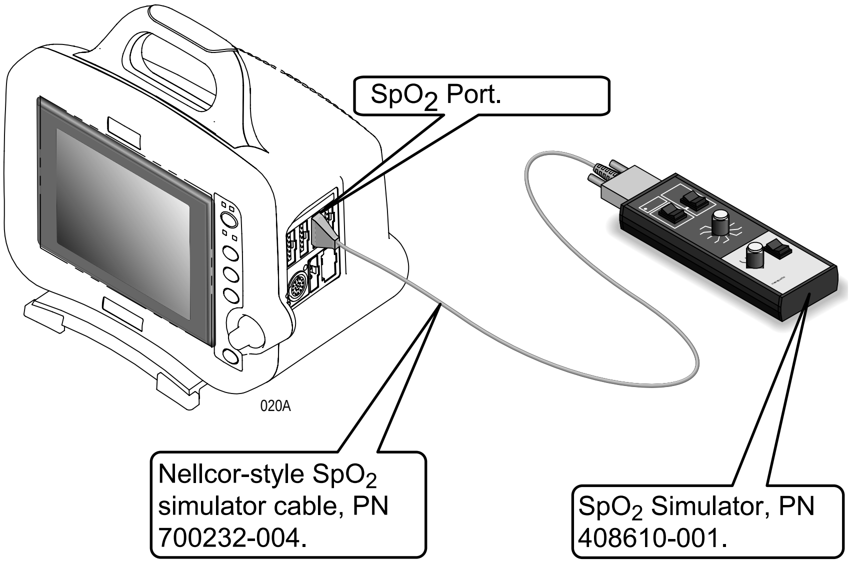

To Connect to the **BP4** Connector
BP2/BP4 connector on monitor
dual BP cable,
PN 2005772-001
867A
blood pressure simulator
cable, PN 700095-001
patient simulator
BP2
BP4

2. Verify the BP parameter window, waveform label, corresponding graticules, and waveform appear on the monitor display, along with a BP waveform requiring zero reference.
3. Press the **ZERO ALL** (**FUNCTION**) key on the front panel of the monitor to zero-reference the BP waveform.
4. Change the patient simulator BP output to 200 mmHg (240 if using the Marq II or MarqIII).

5. Observe a reading of 200/200 (200) ± 4 mmHg (or 240 ± 4 mmHg if using the Marq II or MarqIII) in the BP parameter window on the monitor display.
6. Change the patient simulator BP output to WAVE or to a 120/80 wave form (simulated BP waveform).
7. Observe a distortion-free BP waveform and a reading of approximately 120/80 (93) in the BP parameter window on the monitor display.
8. Disconnect the BP simulator cable from the **BP** connector of the monitor.
9. Complete steps for each enabled **BP** connector.
10. This completes the BP tests.

Pulse Oximetry Tests for GE SPO2 Oximeter

1. Set the pulse oximetry (SpO_2) simulator power switch to the OFF position.
2. Connect the Nellcor-style SpO_2 simulator cable between the SpO_2 connector of the monitor and the SpO_2 simulator.


SpO_2 Port.
020A
Nellcor-style SpO_2 simulator cable, PN 700232-004.
SpO_2 Simulator, PN 408610-001.

3. Set the simulator as follows:
   a. Set the **MODE** to **NELLCOR**.
   b. Set the SpO_2% to **99**.
   c. Set the PRR to **100** beats/min.
   d. Turn the power **ON**.
4. Verify that the following are displayed at the monitor:
   - A sinusoidal waveform with an SpO_2 label.
   - An SpO_2% reading between 97 – 100% (97 and 102%).
   - A PRR reading between 97 and 103 beats per minute (it might be necessary to turn the SpO_2 ON).
5. Test the accuracy of these SPO_2% settings.

Accuracy of SpO_2 Settings	
Simulator Setting	Displayed SpO_2 Value
99% (Both types)	97 – 100% (97 – 102%)
80.3% (84%)	78 – 82% (81 – 87%)
49.7 (63%)	48 – 52% (61 – 65%)

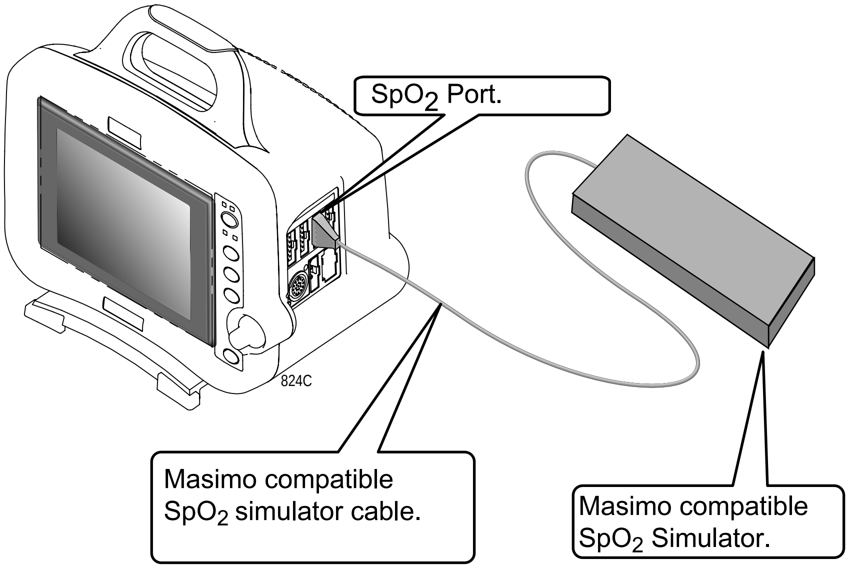
6. Test the accuracy of these PPR settings:

Accuracy of PPR Settings	
Simulator Setting	Displayed PPR Value
70	68 – 72
100	97 – 103
160	156 – 164

7. Return the simulator to these conditions:
   - Set the SpO_2% to **99**.
   - Set the PPR to **100** beats/min.
8. Press the **NOISE TEST** button **ON** the simulator for 30 seconds.
9. Make sure the monitor still displays an SpO_2 value between 97 and 100% (97 and 102%), or an interference detection message is displayed.
10. Turn the simulator **OFF**.
11. Disconnect the simulator cable from the device under test.

Pulse Oximetry Tests for Masimo SET SPO2

1. Connect the Masimo-style SPO2 simulator cable between the SPO2 connector of the monitor and the SPO2 simulator.


SpO_2 Port.
824C
Masimo compatible SpO_2 simulator cable.
Masimo compatible SpO_2 Simulator.

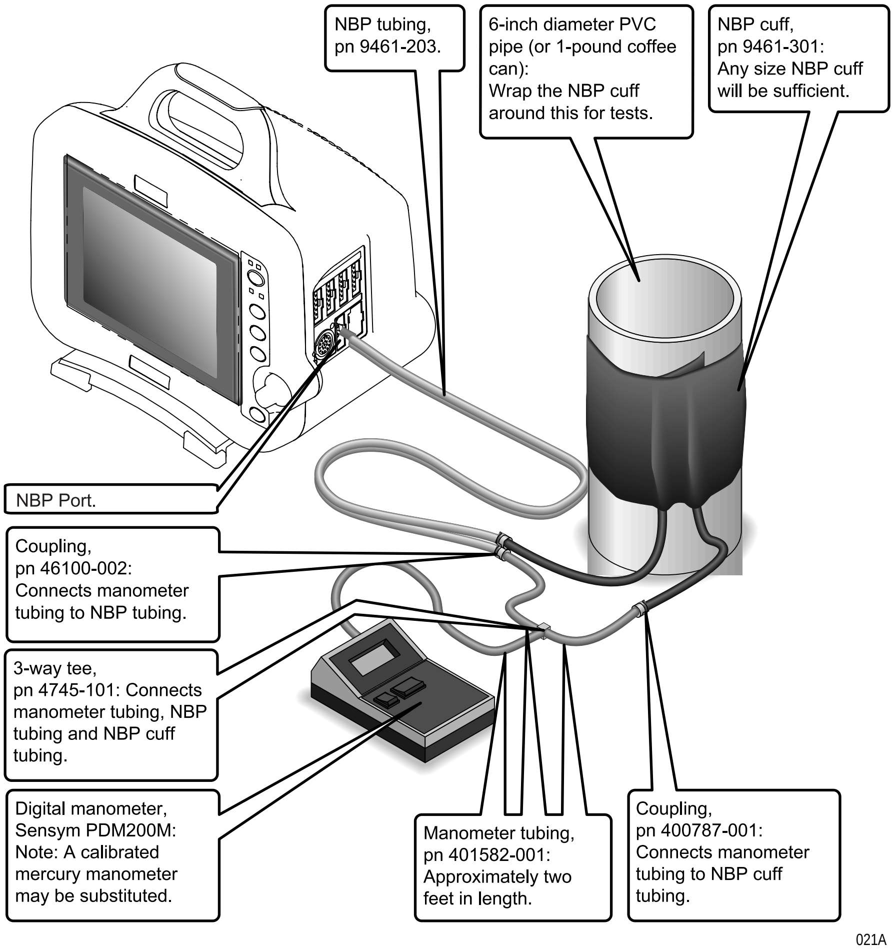
NOTE

Do not connect the simulator to an AC power supply for these tests. Operate the simulator on battery power.

2. Set the simulator as follows:
    a. Turn the monitor on and the simulator power **ON**.
    b. Set the simulator to be compatible with Masimo SET SPO2. For specific set up options, see the documentation provided with the patient simulator.
    c. Set the SPO2 % to **81**.
    d. Set the PRR to **61** beats/minute.
3. Verify the following are displayed at the monitor: (It might be necessary to turn the SPO2 parameter on.)
    - A waveform with an SpO_2 label.
    - An SPO2 % reading between **78 - 84**%.
    - A PRR reading between **58** and **64** beats per minute.
4. Create an alarm condition by setting the SPO2 low limit to **90**%.
5. Make sure the SPO2 % value on the monitor flashes, and it sounds an alarm.
6. Return the low limit to the original value.
7. Disconnect the simulator cable from the module.

Noninvasive Blood Pressure Tests

1. Attach the digital manometer, noninvasive blood pressure (NBP) cuff, tees and tubing, as shown in the illustration below, to the NBP connector of the monitor.


NBP tubing,
pn 9461-203.
6-inch diameter PVC pipe (or 1-pound coffee can):
Wrap the NBP cuff around this for tests.
NBP cuff,
pn 9461-301:
Any size NBP cuff will be sufficient.
NBP Port.
Coupling,
pn 46100-002:
Connects manometer tubing to NBP tubing.
3-way tee,
pn 4745-101: Connects manometer tubing, NBP tubing and NBP cuff tubing.
Digital manometer,
Sensym PDM200M:
Note: A calibrated mercury manometer may be substituted.
Manometer tubing,
pn 401582-001:
Approximately two feet in length.
Coupling,
pn 400787-001:
Connects manometer tubing to NBP cuff tubing.
021A

2. Set the digital manometer power switch to the on position.
3. Set the digital manometer range switch to 1000 mmHg.

Using the **Trim Knob** control, access the Service Mode menu starting from the Main Menu.

1. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select *CALIBRATE > CALIBRATE NBP > CHECK CAL OFF > START.*

   The text on the menu item changes from *CHECK CAL OFF* to *CHECK CAL IN PROGRESS.*

Verify the readings in the NBP parameter window on the monitor display and readings on the digital manometer are equal (± 1 mmHg) for at least one full minute. If the readings are not equal for at least one full minute, the NBP circuit requires calibration.

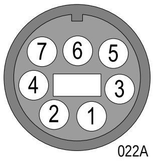
4. Select *CHECK CAL IN PROGRESS > STOP*.

   The pneumatic control circuit of the monitor vents air pressure in the pneumatic circuit of the monitor to atmosphere and causes the NBP cuff to deflate.

5. Remove the NBP test setup apparatus from the monitor. The NBP tests are complete.

Analog Output and Defibrillator Synchronization Tests

1. Use the figure below as a reference for connecting the oscilloscope to the **DEFIB SYNC** connector, located on the back panel of the monitor, for performing these tests.



022A

2. Test the ECG, Arterial BP, and Marker Out signals from the **DEFIB SYNC** connector. They should closely resemble the waveforms in the figures below.

DEFIB Sync Connector: ECG

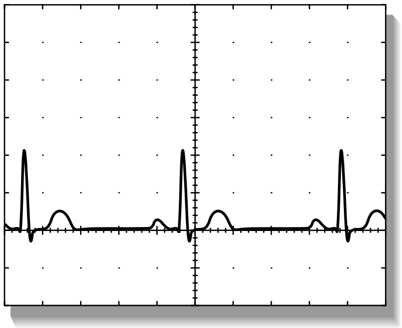
Signal Pin:—7

Ground Pin:—3

Probe Type:—x10

Time/Division:—0.2S

Volts/Division:—0.5V



023A

DEFIB Sync Connector: Arterial BP

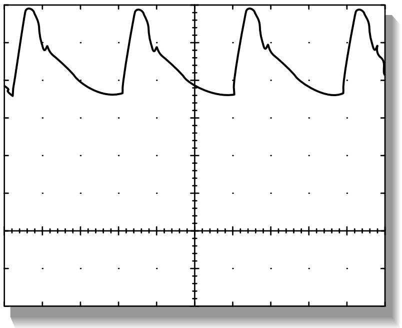
Signal Pin:—6

Ground Pin:—5

Probe Type:—x10

Time/Division:—0.2S

Volts/Division:—0.2V



024A

There are two Marker Out traces shown below. The upper Marker Out figure references the frequency aspects of the signal. The lower Marker Out figure references the pulse width aspects of the signal.

NOTE

The Marker Out amplitude and the pulse width are configured in the boot menu as described in the configuration chapter. The following two graphs indicate an amplitude of 5V and a pulse width of 10ms.

DEFIB Sync Connector: Marker Out (Frequency)

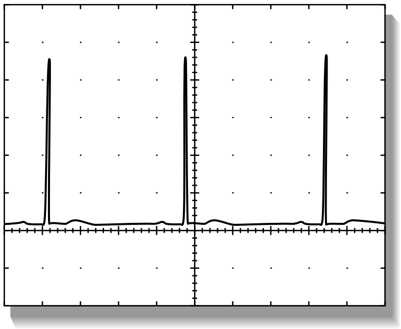
Signal Pin:—1

Ground Pin:—4

Probe Type:—x10

Time/Division:—0.2S

Volts/Division:—1V



025A

DEFIB Sync Connector: Marker Out (Pulse Width)

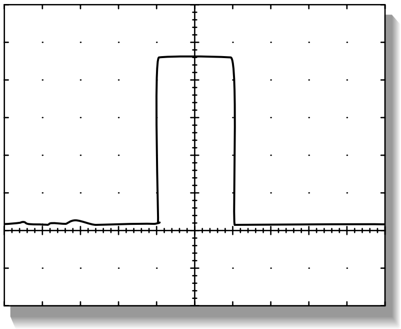
Signal Pin:—1

Ground Pin:—4

Probe Type:—x10

Time/Division:—5mS

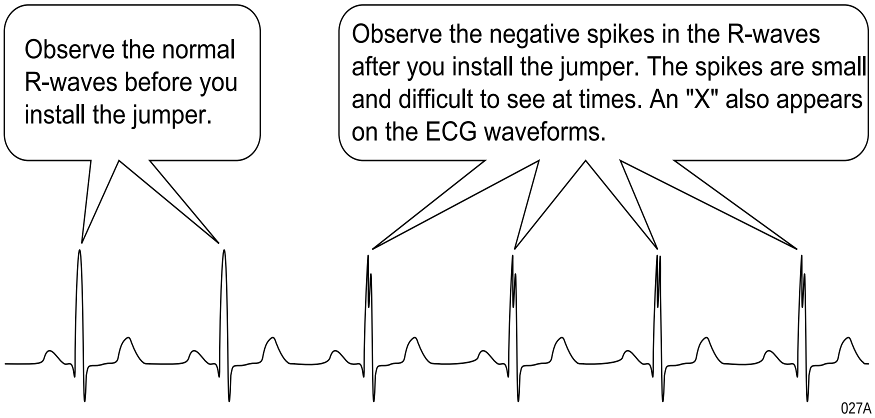
Volts/Division:—1V



026A

Verify Markers

3. Attach a jumper wire between pin-1 (Marker Out) and pin-2 (Marker In) of the **DEFIB SYNC** connector located on the back of the monitor. Verify negative spikes in each of the QRS Complex (ECG waveform) R-Waves on the monitor display, similar to those shown in the illustration below.


Observe the normal R-waves before you install the jumper.
Observe the negative spikes in the R-waves after you install the jumper. The spikes are small and difficult to see at times. An "X" also appears on the ECG waveforms.
027A

4. Remove the jumper wire installed in the previous step, from the **DEFIB SYNC** connector. This completes the defibrillator synchronization tests.

End-tidal CO_2 Test

To verify the mainstream end-tidal CO2, refer to the CO2 chapter in the Dash 3000/4000 Patient Monitor Operator's Manual. This test requires you perform a zero and reference check by using the sample cells provided on the end-tidal CO2 cable.

For instructions on verifying sidestream end-tidal CO2 and setting the sample line to zero, refer to the CO2 module operator instructions.

Battery Tests

1. Disconnect the power cord plug from the wall receptacle.
2. Verify the **BATTERY** front panel indicator illuminates. This indicates operation from the monitor's battery power.
3. Setup the patient simulator as follows:
    - ECG heart rate – 80 bpm,
    - ECG amplitude – 1.0 mV,
    - 5-lead patient cable attached.
4. Observe the following:
    - ECG Lead II is displayed and is noise-free,
    - Heart rate of 80 ±1 bpm is displayed,
    - With *QRS VOLUME* enabled, an audible tone sounds with each R-Wave.
5. Verify all six ECG leads are selectable for display on the monitor.
6. Connect the power cord plug to the wall receptacle.
7. Verify the AC front panel indicator illuminates. This indicates the monitor is operating from wall receptacle (AC) power.
8. Verify the **CHARGING STATUS** front panel indicator illuminates for a few minutes.
    - An amber glow indicates the monitor battery is charging.
    - A green glow indicates the monitor batteries are fully charged.

Graph Test

Using the **Trim Knob** control, access the Service Mode menu starting from the Main Menu.

1. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE*.
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select *GRAPH TEST PATTERN > START*.
4. Verify the following:
    - Fonts.
    - Shading.
    - Triangle Pattern.
    - No missing dots.
5. Select *GRAPH TEST PATTERN > STOP*.

Graph Speed Test

Using the **Trim Knob** control, access the Graph Setup menu starting from the Main Menu.

1. Select *MORE MENUS* > *MONITOR SETUP* > *GRAPH SETUP*.
2. Select *SPEED:25* (default).
3. Verify that all eight speeds work.

Display Test

1. Hold the **NBP GO/STOP** and the **ZERO ALL** keys and press the **Trim Knob** control at the SAME time.
2. Release the **Trim Knob** control immediately.
3. Continue holding the **NBP GO/STOP** and the **ZERO ALL** keys.
4. Select "Video Test Screens."
5. Test all screens:
   - White Screen.
   - Red Screen.
   - Blue Screen.
   - Green Screen.
   - Vertical Bars.

Speaker Test

1. Change the alarm volume of the monitor to 100%.
2. Verify the speaker volume of the monitor changes accordingly.
3. Return the volume of the monitor to the level it was previously set to, before you changed it for this test.

Network Test

1. Verify that the monitor is connected to the Unity-MC (Mission Critical) network.

   NOTE

   When the monitor is connected to a docking station, verify the docking station is connected to the Unity-MC network.

   NOTE

   When the monitor is connected to a docking station, the monitor’s network port is disabled. Only the docking station’s network port is enabled at this time.

2. Select *VIEW OTHER PATIENTS*.
3. Select *SELECT ANOTHER CARE UNIT*.
4. Verify that you can see at least one care unit.
5. Select a care unit.
6. Select *SELECT A BED TO VIEW*.
7. Select a bed.
8. Verify that the patient window appears on the monitor’s split-screen.

Remote Control Test (Option)

1. Verify the remote control is connected into an Autoport to Mport adapter and is inserted into the **Aux** connector.
2. Select *MORE MENUS > MONITOR SETUP > REVISION AND ID.*
3. Select *NEXT* from the popup menu to display the port connectors.
4. Verify the Remote Control label appears after the appropriate port and the software version for the remote control is 1A.
5. Press each remote control key and verify a beep tone sounds at the monitor.

RF LAN Test (option)

1. If the monitor has the Wireless LAN, disconnect the Ethernet cable and verify Wireless LAN communication still exist between beds,
2. Reconnect the Ethernet Cable.
3. Return to the Main Menu.

Dash Port Docking Station Test

Electrical Safety Tests

When the monitor is connected to the docking station, perform ALL the tests described in "Electrical Safety Tests" starting on page 4-24.

Operation

Complete the "Checkout Procedures" located in the "Dash Port Docking Station Service Manual."

RAC 2A Module Housing Peripheral Device Test

Electrical Safety Tests

Because the RAC 2A module housing has a separate power supply, perform electrical safety tests separate from the monitor.

Refer to the "Electrical Safety Tests" section of this chapter and complete the following tests.

1. Wall Receptacle Test
2. Ground (earth) Continuity Test,
3. Ground (earth) Wire Leakage Tests, and
4. Enclosure Leakage Current Test.

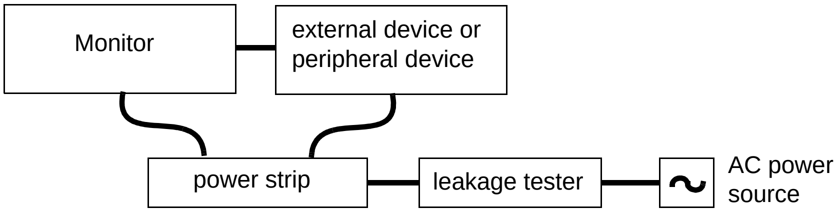
Operation

Complete the "Maintenance Schedule" procedures found in the "RAC 2A Module Housing Service Manual."

Peripheral or External Devices

Electrical Safety Tests

When a peripheral or external device has a separate power supply, complete a combined electrical safety test with the monitor and peripheral device as shown below.



Complete the “Electrical Safety Tests” on page 4-24.

Operation

Complete the checkout procedures identified in the peripheral or external device’s service manual.

Checkout Procedures Completion

This completes all tests associated with the checkout procedures.

1. Discharge the test patient admitted during the “ECG Tests” on page 4-37.
2. Set all test equipment power switches to the off position.
3. Unplug the monitor (or docking station) from AC power.
4. Remove all test equipment from the monitor (or docking station).

PM Form

Due to continuing product innovation and because specifications in this manual are subject to change without notice, a PM form is not included with this manual. For the latest PM form regarding this product, contact GE Service.

If repairs/adjustments were made or any parts replaced, describe this in the area provided on the PM form.

Also include comments regarding any unusual environmental conditions that may affect the operation or reliability of the equipment in the area provided on the PM form.

On the following pages a repair log is included for your convenience to record the repair history of this product.

Repair Log

Unit Serial Number:
Institution Name:

Date	Maintenance/Repair	Technician

Repair Log

Unit Serial Number:
Institution Name:

Date	Maintenance/Repair	Technician

5 Troubleshooting

For your notes

Service Menus

There are two distinct service menus for the monitor. The Service Mode menu is found in the monitor's Main Menu and is used for various functions like calibration, graph tests, and downloading monitor interface software. The Boot Loader Service Menu is found in the Boot Code and is used when downloading the Boot Code and main processor code.

Both service menus are generally used by qualified field engineers and factory service personnel to troubleshoot, repair, or download new software to the patient monitor.

WARNING
The Boot Loader Service Menu and the Service Mode menu is intended for qualified personnel only. It is possible to lose patient data, damage the operating software for this monitor, and even affect the Unity Network. Do not 'experiment' with any commands found in the service menus.

Boot Loader Service Menu

Use the Boot Loader service menu when downloading new Boot Code or Main Code software to the patient monitor or when the patient monitor exhibits a serious failure. Activate the Boot Loader program as follows:

1. Hold down **NBP GO/STOP** and **ZERO ALL** (**FUNCTION**) on the front panel.
2. Press and release the **Trim Knob** control.
3. Keep holding **NBP GO/STOP** and **ZERO ALL** (**FUNCTION**) until the Boot Loader information appears on the display.

Following is a list of options in the boot code service menu.

<table>
<tr><th colspan="2">Boot Loader Service Menu Options</th></tr>
<tr><th>Menu Option</th><th>Description</th></tr>
<tr><td><i>CHANGE INTERNET ADDRESS</i></td><td>This option is used when changing the internet protocol (IP) address.</td></tr>
<tr><td colspan="2">WARNING
Duplication of an Internet address on a network causes data loss and possible Unity Network problems. If you change the factory assigned Internet address, you must record all other Internet addresses used on your network to avoid duplication.</td></tr>
<tr><td><i>SHOW INSTALL OPTIONS</i></td><td>This option lists the options installed on the monitor.</td></tr>
<tr><td><i>CLEAR CONFIGURATION MEMORY</i></td><td>This option erases all patient histories and programmed defaults in the monitor’s protected memory. Clearing the configuration memory returns the monitor defaults to the factory installed defaults.</td></tr>
<tr><td><i>SET CONFIGURATION</i></td><td>This menu contains options for configuring the monitor.
Refer to “Boot Code Selections” on page 6-9.</td></tr>
<tr><td><i>VIDEO TEST SCREENS</i></td><td>Various color screens for testing the display.</td></tr>
<tr><td><i>BATTERY SIMULATION</i></td><td>This option is for engineering use only.</td></tr>
<tr><td><i>WAKE UP BATTERY</i></td><td>This option is used when the battery is dead. Refer to “Battery Messages Displayed in the Battery Fuel Gauge Icon” on page 5-13.</td></tr>
<tr><td><i>OPTIONS MENU</i></td><td>A unique password is required for each option. Contact your sales/service representative to obtain a password. You must provide your product serial number and Ethernet address. (The Ethernet address is displayed in the Boot Code banner information.)</td></tr>
</table>

Main Menu Service Mode Menu

The Service Mode menu option items provide the user access to several general and technical built-in software functions of the monitor. Only persons responsible for configuring and maintaining the monitor should access the service mode menu option items.

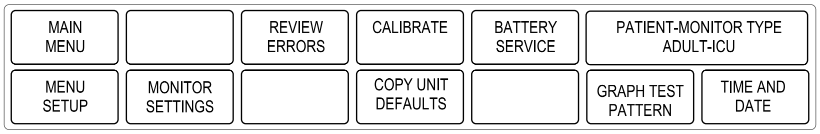
WARNING

The Service Mode menu is intended for use only by qualified service technicians. Experimentation with service mode menu option items can be detrimental to the monitor. Lost patient data, damaged operating system software for the monitor, even network related problems are but a few examples of problems that can be induced as the result of tampering with service mode menu option items.

Access the Service Mode

Access the Service Mode menu starting from the Main menu.

1. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE >*
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407).



030B

About Service Mode Menu Option Items

The Service Mode menu is used for initial setup and configuration as well as for troubleshooting. ALWAYS exercise caution when using any of these password-protected functions.

The service technician can use the Service Mode menu to:

- relay software information to design engineers;
- calibrate and troubleshoot NBP functions of the monitor;
- set admit menu options, operating mode of the monitor, and monitor default password;
- configure the monitor unit name, bed number and Internet address for use on the network; and
- enter or change the time and date on the monitor.

Do NOT use ANY of these options unless specifically instructed to do so.

WARNING
Some of the service mode menu option items are to be used only by qualified service technicians and others are for general use. Because of this, unnecessary tampering with service mode menu option items for experimentation purposes is not recommended by GE and may cause a malfunction of the monitor.

Service Mode Menu Option Items

Following is a list of options in the main code service menu.

Service Mode Menu Options

Menu Option	Description
Review Errors	This menu selection is for advanced troubleshooting by GE engineers. Error log data can be transferred over the network to a central station and then loaded onto a diskette for review. (Review Errors is discusses in greater detail later in this chapter.)
Calibrate	For checkout or calibration of the noninvasive blood pressure, ECG analog output, BP analog output, CO_2 service, and SAM service menu functions of the monitor.
Battery Service	This is a complete collection of battery data for troubleshooting the batteries.
Patient-Monitor Type	Select the type of monitor desired, i.e adult, neonatal or operating room. Refer to Chapter 6, "Configuration" for detailed procedures.

WARNING
Changing the patient-monitor type will default the admit function to Standard configuration. Different alarms and parameters are activated for each selection.

NOTE
The keypad/remote control is DIDCA programmed for specific monitor types. The error message, "*WARNING: REMOTE MISMATCHED WITH MONITORING MODE"* displays if the monitor and keypad/remote control do not match.

Service Mode Menu Options (Continued)	
Menu Option	Description
MENU SETUP	This menu selection provides the following sub-menus: (Refer to Chapter 6, "Configuration" for detailed procedures.) ■ *ADMIT MENU: STANDARD* This menu selection allows you to determine the function of the patient monitor. The four variables include stationary or ambulatory (telemetry) patient monitoring with a monitor that always stays in one room (STANDARD) or a monitor that moves from room to room (*ROVER*). ■ *MONITOR DEFAULTS PASSWD* This menu selection allows you to set the monitor so that a password is Required or Not Required for entry into the Monitor Defaults menu section. If selected, the password will be the same as the Service Mode Menu password.
MONITOR SETTINGS	This menu selection provides the following sub-menus: (Refer to Chapter 6, "Configuration" for detailed procedures.) ■ *SET UNIT NAME* This menu selection allows changes to the care unit name. After initial setup, this name should not be changed or communication to the central station will be corrupted. Note that the care unit name must be registered exactly the same in the central station and the patient monitor. ■ *SET BED NUMBER* This menu selection allows changes to the bed number. After initial setup, this number should not be changed or communication to the central station will be corrupted. Note that the bed number must be registered exactly the same in the central station and the patient monitor. ■ *SET INTERNET ADDRESS* This menu selection allows changes to the internet (IP) address. An incorrect internet address may also prevent the monitor from viewing other monitors on the network even though the unit names match. Whether or not this can occur depends on the network topology at the installed site.

<table>
<tr><th colspan="2">Service Mode Menu Options (Continued)</th></tr>
<tr><th>Menu Option</th><th>Description</th></tr>
<tr><td colspan="2">WARNING
Duplication of an internet (IP) address on a network causes lost data. If you change the factory assigned internet address, you must first record all other internet addresses used on your network to avoid duplication.

NOTE
An incorrect internet address may also prevent the monitor from viewing other monitors on the network even though the unit names match. Whether or not this can occur depends on the network topology at the installed site.</td></tr>
<tr><td><i>MONITOR SETTINGS</i></td><td>■ <i>STORE DEFAULTS FOR NETWORK TRANSFER</i>
This menu selection saves the monitor defaults for transfer to another monitor with the same software version, software package, patient monitor type, and country code. It stores all monitor defaults, custom default names, and 12 SL location and site.
■ SET LOCATION ID
Enter the location identification for the MUSE system.
■ SET SITE NUMBER
A site number may be necessary if your institution has multiple buildings. A MUSE system can be used as a site number.</td></tr>
<tr><td><i>COPY UNIT DEFAULTS</i></td><td>This menu option is used to copy monitor defaults from one monitor to another monitor. Refer to Chapter 6, “Configuration” for detailed procedures.</td></tr>
<tr><td><i>GRAPH TEST PATTERN</i></td><td>This menu selection allows you to run a graph test pattern. The choices are Start and Stop.</td></tr>
<tr><td><i>TIME AND DATE</i></td><td>This menu selection allows changes to the time and date and may affect the time and date for the entire monitoring network. (Refer to Chapter 6, “Configuration” for detailed procedures.)</td></tr>
<tr><td colspan="2">WARNING
Loss of patient history. This menu should rarely be used because patient histories will be lost.</td></tr>
</table>

Review Errors

The Review Errors menu is an advanced troubleshooting tool used by GE engineering personnel. Some of the information recorded in the monitor error log can be useful for field service troubleshooting.

About the Monitor Error Log

This section provides an introduction to error log usage and meaning. Because the information contained in the error log is engineering-oriented, the intent of the manual is to simply provide a general understanding of this monitor function.

Downloading the Error Log

This section includes a method for downloading error log data over the network to a central station. Once downloaded to a central station, you can load the error log data onto floppy diskettes or review it on the central station.

NOTE

The Unity Network software option must be enabled in order to download the error log over the network to a central station.

Accessing the Review Errors Menu Option Item

To access the error log and learn more about the Review Errors menu option item, follow these steps:

1. Rotate and press the **Trim Knob** control to select *REVIEW ERRORS* from the Service Mode Menu.
2. The review errors menu option items include four possible selections; one each for viewing output or input errors along with one each for clearing output or input errors. Rotate and press the **Trim Knob** control to scroll to and select *VIEW OUTPUT ERRORS* from the Review Errors Menu.
3. The Run Time Error Log pop-up window appears on the left side of the monitor display. One time-dated output software error appears in the pop-up window at a time.
4. Use the **Trim Knob** control to scroll through each logged error and peruse all of the parameters associated with each output software error. Rotate the **Trim Knob** control to move the cursor (>) to a position for viewing the Next or Previous error as well as the position that allows the user to Quit viewing output errors.
5. Selecting Quit closes the Run Time Error Log pop-up window and returns to the Review Errors Menu.

6. The View Input Errors menu causes a Run Time Error Log pop-up window to appear on the monitor display. The pop-up window now displays input software errors and provides basically the same information as the View Output Errors pop-up window provided. The appearance of both pop-up windows are similar, the difference being errors that are logged as input versus output to/from the monitor.
7. To clear out the stored run time error logs, use the **Trim Knob** control to select the *CLEAR OUTPUT ERRORS* or *CLEAR INPUT ERRORS* menu, respectively.

   Immediately after you clear one of the error logs, a message appears on the upper right side of the display. The message verifies the actuation of the **Trim Knob** control for this function.

Error Log Information

This part of the section describes in greater detail what information the error log contains and what can be learned from error logs.

An error log in the monitor can hold up to 50 events. As an event occurs, error information is stored in the log. Subsequent events are stored sequentially as they occur. When the 50-event limit is reached, subsequent errors replacing the oldest error(s) in the log.

A sample of the monitor error log pop-up window appears as follows:

When using the error log to troubleshoot a problem with the monitor, the following parameters from the pop-up window that are of greatest interest are as follows.

Error Log Parameters

Parameter	Description
PROCESS NAME	The task that was operating when the event or problem occurred.
ERROR CODE	A software code for the type of event or problem that occurred.
SEVERITY	Indicates the level of impact of the event or problem on the system.
DATE	The date the event or problem occurred.
TIME	The time the event or problem occurred.
ERROR NUMBER	A sequential number used to identify each event or problem.
INPUT ERROR	Additional information used to determine the cause of the error.

Error Logs

Error logs contain more than just operating system errors. Many events that occur that might have an impact upon the system are entered into the log. These logs may be requested by Tech Support on occasion to aid in troubleshooting the monitor. The logs are developed to aid engineering for internal diagnostics of the monitor. Contact Tech Support if you need clarification of any of the error logs.

Severity of the Error

Severity is a measure of how the event/error affected the system. There are three levels of severity. The following is a list of these levels accompanied by a brief description of each.

Severity of the Error

Error	Description
CONTINUE	The event or error was logged, the task may or may not have completed, but the system was able to continue operating. Most error log entries have this severity level.
FATAL	The event or error was logged, the task did not complete, and the system was unable to continue operating as recovery was not possible. This level of severity in an event or error is always followed by an automatic warm start.
FORCED RESET	The operating system restarted normally after a known condition, such as an Internet address change, patient discharge, etc.

Battery Alarms and Messages

Battery alarms occur when one of the following battery conditions occur:

- Low battery
- Empty battery
- Battery failures
- Charger failures

These Battery messages help identify the cause of a battery alarm. Battery Messages appear in three different locations of the monitor:

- ECG waveform area.
- Battery Status Information window.
- Battery Fuel Gauge icon.

Battery Messages Displayed in the ECG Waveform Area

The following battery messages are displayed in the ECG Waveform Area.

Battery Messages Displayed in the ECG Waveform Area

Message	Battery Alarm	Cause
BATTERY LOW	System *WARNING*	Critical Low Battery—Only 10 minutes per battery of run time remaining (10 minutes if one battery, 20 minutes if two batteries).
POWERING DOWN	System *WARNING*	Empty Battery—There is no battery run time remaining.
CHECK BATT STATUS	System *MESSAGE*	Battery Failure—A minor failure has occurred while using or charging the battery.
BATTERY ERROR	System *WARNING*	Battery Failure—A serious failure has occurred while using or charging the battery.
CHECK BATT STATUS NOTE *INTERNAL CHARGER FAILED, CALL SERVICE* also appears in the Battery Status information window.	System *MESSAGE*	Charger Failure—Charger communications have failed.

Battery Messages Displayed in the Battery Status Information Window

Battery Messages Displayed in the Battery Status Information Window

Message	Battery Alarm	Cause
INTERNAL CHARGER FAILED, CALL SERVICE **NOTE** *CHECK BATT STATUS* also appears in the ECG waveform area.	System *MESSAGE*	Charger Failure——Charger communications have failed.
CONDITION	None	Condition ——The battery is requesting a conditioning cycle.

Battery Messages Displayed in the Battery Fuel Gauge Icon

The following battery message is displayed in the Battery Fuel Gauge icon.

Battery Messages Displayed in the Battery Fuel Gauge Icon

Message	Reason	Solution
ERROR	The battery is either asleep or faulty.	The current status of the battery's health is in question. The Battery Status information window will provide more specific information about the health of the battery. See, "Identifying Battery Status Using the Battery Status Menu" on page 4-14. ■ If the battery is asleep and you need to "wake up" the battery, see "How to Wake Up the Battery" on page 4-19. ■ If the battery will not "wake up" it is probably faulty and should be replaced.

Power Source Tests

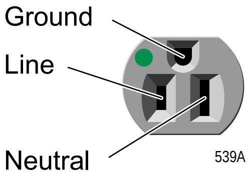
Wall Receptacle

Use this procedure to confirm AC power from the wall receptacle which the monitor is plugged into.

Use a digital multimeter (DMM) to verify the wall receptacle is wired correctly. This is accomplished by performing a:

- voltage measurement between all three connections of the wall receptacle;
- ground-to-neutral loop resistance measurement.

A standard wall receptacle consists of three connections: line, neutral and ground. The figure below indicates the location of each on a 120 VAC wall receptacle commonly used in the United States. The location and shape of pins may be different on wall receptacles used in countries other than the United States.



Perform the following tests:

1. Use a DMM to measure the voltage between the three connections.
    a. Select the AC voltage scale on the DMM.
    b. Measure the voltage from line to neutral, line to ground, and neutral to ground and make sure these are correct. With a correctly wired wall receptacle used in the United States, the following readings should be obtained:

       Line to neutral: 120 VAC
       Line to ground: 120 VAC
       Neutral to ground: < 3 VAC

       Readings other than these indicate improper wiring. Have the wall receptacle checked by an electrician.

2. Use a DMM to measure the ground-to-neutral loop resistance.

> **CAUTION**
> DO NOT check the ground-neutral loop resistance unless the wall receptacle is correctly wired.

   a. Select the milliohms (mΩ) scale on the DMM.
   b. Measure resistance across the power cord ground and neutral.
   c. Measure from the ground lug on the rear power connector to any exposed metal of the monitor. The resistance between the ground and neutral connections, after the ohmmeter is nulled, must be less than 100 mΩ. If not, have the wall receptacle checked by an electrician.

Power Cord and Plug

Verify the power cord being used with the monitor is good. The following are a couple of things to check for in this regard:

- Failure of the power cord strain relief is very common. Often times users of the equipment pull on the power cord itself, rather than the power cord plug, to unplug the monitor from a wall receptacle. If in doubt, test for continuity through each conductor of the power cord connector and plug.
- Verify line, neutral, and ground conductors are properly connected to the power cord plug and are not short-circuited. Rewire and tighten these, or replace the power cord, as necessary.

Data Acquisition Tests

ECG Functions

1. Connect the Multifunction Microsimulator (pn MARQII) and appropriate patient cables, to the ECG connector of the monitor. Turn the monitor and the patient simulator on.
2. Set the monitor to display leads I, II, III, and V simultaneously:
   a. From the main menu, select *DISPLAY OPTIONS*.
   b. Make sure the Display menu item shows Individual plus six waveforms. If it shows Full, change it to Individual.
   c. Select *WAVEFORMS ON/OFF* from the menu.
   d. Set the displayed waveforms for the following ECG leads:

ECG 1	WAVEFORM 2	WAVEFORM 3	WAVEFORM 4
LEAD II	LEAD V	LEAD I	LEAD III

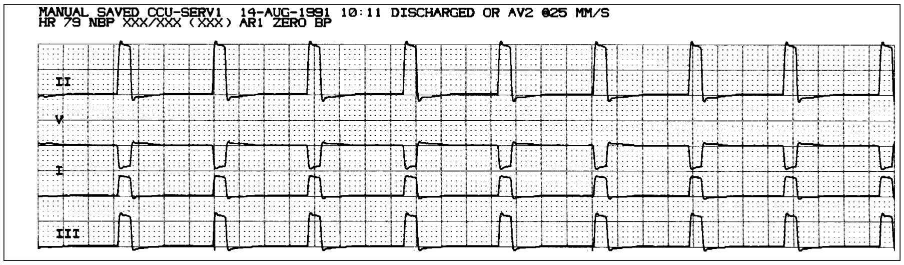
3. Set the patient simulator to output calibration (cal) pulses at 1.0 mV.
4. Measure the cal pulse (⎍) amplitude. These should be (+/–20%):
   - Lead I:0.5 mV
   - Lead II:1 mV
   - Lead III:0.5 mV
   - Lead V:–0.5 mV

5. It may be necessary to run a graph to accurately measure the cal pulses. Perform these steps to graph all four waveforms.
   a. From the main menu, select *GRAPH & ALARMS*.
   b. Select *GRAPH CONTROL* from the menu.
   c. Set the graphed waveforms for the following ECG leads:

ECG 1	WAVEFORM 2	WAVEFORM 3	WAVEFORM 4
LEAD II	LEAD V	LEAD I	LEAD III

   d. Press the **GRAPH GO/STOP** front panel control on the monitor to start and stop a manual graph.

e. Compare the printed graph with the sample shown below.



MANUAL SAVED CCU-SERV1 14-AUG-1991 10:11 DISCHARGED OR AV2 @25 MM/S
HR 79 NBP XXX/XXX (XXX) AR1 ZERO BP

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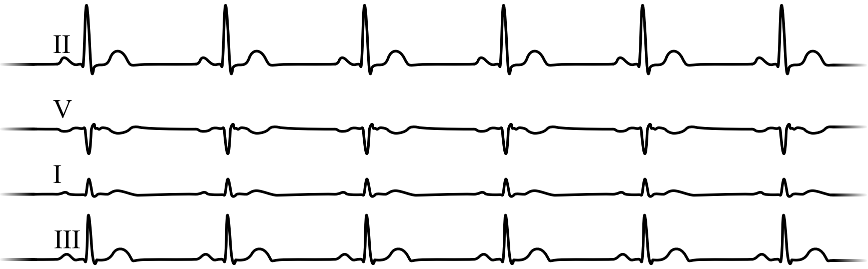
f. Change the patient simulator output from cal pulses to an 80-bpm ECG waveform.

The displayed ECG waveforms should be similar to those shown in the figure below.



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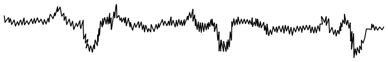
If this is the case, the ECG functions of the acquisition PCB, as well as communication between the acquisition and processor PCBs function as designed.

ECG Waveforms Display Incorrectly

1. If the calibration pulses are NOT correct, test the patient simulator using a working monitor. If the patient simulator functions as designed, calibrate the acquisition PCB. Refer to Chapter 7, “Calibration”
2. If displayed ECG waveforms contain a significant amount of noise, check the ECG patient cables.



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3. Test the patient simulator and ECG patient cables on a working monitor to verify the ECG signal.
4. If the ECG signal, patient simulator and ECG patient cables are good, the acquisition PCB is suspect and you need to replace it.

ECG Waveforms Do Not Display At All

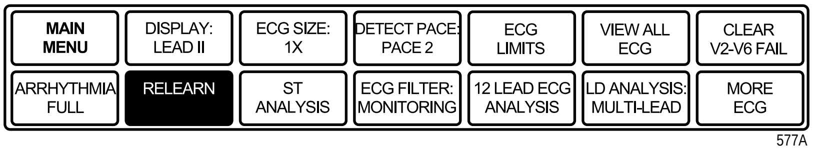
1. Test the ECG patient cables on a working monitor.
2. Test the patient simulator on a working monitor.
3. Swap the acquisition PCB into a working monitor. If the symptoms follow the PCB into the working monitor, replace the acquisition PCB.
4. If none of these first three steps provide any results, swap the processor PCB and/or power supply PCB into a working monitor.

Lead Fail Functions

1. With the monitor displaying leads I, II, III, and V from the patient simulator, remove the RA leadwire from the patient simulator.
2. The monitor should display a warning of a RA FAIL message. Lead fail detection functions properly if this is the case. Lead fail detection does not function properly if this is NOT the case. The acquisition PCB is suspect. Swap the PCB with a working monitor to verify the malfunction.
3. Reattach the RA leadwire to the patient simulator.

Pace Detect Functions

1. With the monitor displaying leads I, II, III, and V, set the patient simulator to output a VP1 (ventricular pacemaker simulation #1) waveform.
2. Enable the pacemaker detection function of the monitor.
   a. Select *ECG* from the display main menu,
   b. Select *DETECT PACE* and set to *PACE 2*.
3. Verify the heart rate remains at approximately 80 bpm.
4. Select the VP2 output (ventricular pacemaker simulation #2) on the patient simulator.
5. Select and press *RELEARN*.


MAIN MENU
DISPLAY: LEAD II
ECG SIZE: 1X
DETECT PACE: PACE 2
ECG LIMITS
VIEW ALL ECG
CLEAR V2-V6 FAIL
ARRHYTHMIA FULL
RELEARN
ST ANALYSIS
ECG FILTER: MONITORING
12 LEAD ECG ANALYSIS
LD ANALYSIS: MULTI-LEAD
MORE ECG
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6. The heart rate number may disappear from the display for a few seconds and return to the screen shortly thereafter. Verify the heart rate is at approximately 80 bpm. Verify the pacemaker spikes display at the same amplitude.
7. Disable the pacemaker detection function of the monitor. Verify the displayed pacemaker spikes have a different amplitude than in the previous step.

8. Select the AVS output (A/V sequential pacemaker simulation) on the patient simulator.
9. Select and press *RELEARN*.
10. Verify the displayed pacemaker spikes are at different amplitudes.
11. Select and press *RELEARN*.
12. Enable the pacemaker detection function of the monitor once again.
13. Set *ECG GAIN* to *X2*.
14. Verify a stable heart rate display of approximately 80 bpm. Verify the pacemaker spikes are again at the same amplitude.
15. Disable the pacemaker detection function of the monitor.

Pace Detect Functions Do Not Work Properly

If the pacemaker detection test results are not correct, as described above, complete the following steps.

1. Verify the patient simulator functions correctly by testing it on a working monitor.
2. If the simulator is functioning correctly, the acquisition PCB is suspect. Swap a working acquisition PCB into the monitor and perform this test to verify correct operation.

Invasive Blood Pressure Functions

The invasive blood pressure (BP) test procedure requires the use of the following patient simulator: Multifunction Microsimulator (pn. MarqII or MarqIII). If you need to use a different patient simulator, adjust the procedure steps/readings accordingly.

Setup BP

Connect the Blood Pressure output of the patient simulator to each enabled BP patient connector on the side panel of the monitor.

Zero-Reference Enabled BP Input

Properly zero-reference each enabled BP input.

1. Set the patient simulator BP output to 0 mmHg
2. Press the **ZERO ALL (FUNCTION)** key on the monitor.

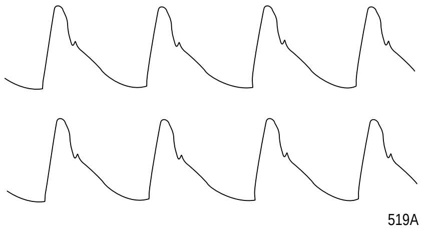
Generate Dynamic BP Waveforms

1. Set the patient simulator BP output to a 120/80 Wave.
2. Setup the BP scales on the monitor to best match the waveform output.
3. Repeat steps 1 and 2 for each enabled BP channel.

Verify Dynamic BP Results

Once the BP waveforms are setup as described above verify the following:

- Waveforms are noise-free, as shown in the figure below.



- BP displayed parameters are within tolerance as indicated in the following list:

BP Parameter:	AR1
Systolic (mmHg):	116 – 124
Diastolic (mmHg):	78 – 82

NOTE

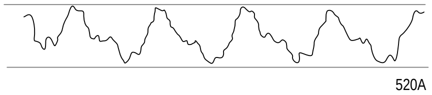
These tests are designed for use with a Multifunction Microsimulator, pn. MarqII or MarqIII. Accuracy specifications of the patient simulator in combination with the monitor (±2% or 1 mmHg, whichever is greater) is how the parameter values listed above, were derived. Use of any other manufacturer patient simulator, and associated specifications, can potentially change these test results.

Generate Static BP Waveforms

1. Set the patient simulator BP output to 200 mmHg (240 mmHG MarqII or MarqIII), static pressure.
2. Verify the BP channel is working correctly if systolic, diastolic, and mean pressure values for BP are displaying parameter readings between 194 and 206 mmHg.
3. Repeat steps 1 and 2 for each enabled BP channel.

BP Waveforms Do Not Appear Correctly On The Display

1. If the BP waveforms displayed on the monitor appear noisy or distorted (example shown on the left), test the Patient simulator and simulator test cables and on a working monitor to determine the source of the problem.



2. If the static pressure test results were inaccurate, test the Patient simulator and simulator test cables and on a working monitor to determine the source of the problem.
3. If the patient simulator and associated test cables are determined to be functioning correctly, replace the DAS FRU. See Chapter 8, "Field Replaceable Units and Upgrades"

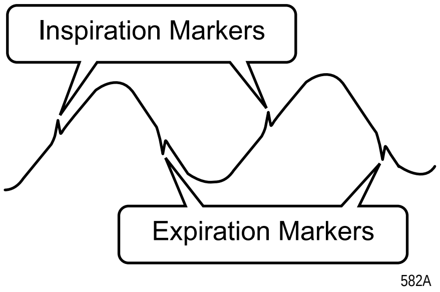
BP Waveforms Do Not Appear On The Display At All

1. If the BP parameter labels, readings and associated waveforms do not display on the monitor, verify the patient simulator and associated test cables on a working monitor.
2. Inspect the BP side panel connectors on the monitor for bent or broken pins. If any pins are bent or broken, replace the DAS assembly.
3. Inspect the dual BP cable connectors on the monitor for bent or broken pins. If any pins are bent or broken, replace the DAS assembly.

Respiration Functions

Connect the Multifunction Microsimulator, pn. MARQII, and appropriate patient cables to the ECG/RESP side panel connector on the monitor.

1. Adjust the patient simulator to output a respiration waveform using the following settings:
   - Rate BPM – 30
   - Baseline Impedance Ohms – 750 (1000 Ohms MARQII),
   - ΔR Ohms – 2.0.
2. Enable the respiration function of the monitor.
   a. Select *MONITOR SETUP* from the main menu display on the monitor,
   b. Select *PARAMETERS ON/OFF* from the monitor setup menu.
   c. Turn and push the **Trim Knob** control to scroll to and select *RR* in the parameters on/off pop-up window.
   d. Toggle and select *ON* in the RR line of the parameters on/off pop-up window.
3. Verify the following:
   - Respiration rate is displayed and accurate.
   - Respiration waveform is displayed and noise-free.
   - Markers appear in the displayed respiration waveform (see figure below). These indicate the points at which the monitor senses inspiration and expiration for determination of the respiration rate.



No Respiration Waveform or Rate Appear on the Display

If the respiration waveform or rate does not appear on the monitor display, perform the following steps to isolate the problem.

1. Vary the baseline impedance on the patient simulator
2. Vary the ΔR on the patient simulator.
3. Test the patient simulator and appropriate patient cables on a working monitor to determine the source of the problem.
4. If none of the previous recommendations corrects the problem, the acquisition PCB is suspect. Swap the PCB into a working monitor to determine the source of the problem and replace as necessary.

Markers do not Appear on Respiration Waveform; Respiration Rate is Inaccurate

If the markers on the respiration waveform do not appear on the display or the respiration rate count is inaccurate, try changing the respiration sensitivity level on the monitor. Use the **Trim Knob** control on the monitor to select the following menu options.

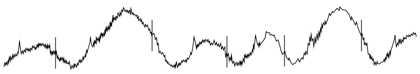
1. Scroll to and select *RR* (respiration parameter) from the monitor main menu,
2. Scroll to and select *SENSITIVITY* from the respiration parameter menu, and
3. Scroll to and select a different sensitivity percentage (%) from the sensitivity menu

   NOTE

   Usually, a lower respiration sensitivity % level rectifies this problem.

Respiration Functions Work Properly on Patient Simulator but not on Actual Patient

Refer to the Operator's Manual for detailed information regarding patient preparation relative to respiration monitoring functions. Achieving optimum results for respiration waveforms and accurate respiration rate detection by the monitor requires proper preparation for ECG electrode placement on the patient. Following is an example of a noisy respiration waveform which is usually due to bad patient preparation.



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NOTE

With patients that exhibit excessively high baseline chest impedance, proper respiration monitoring can be extremely difficult, if not impossible.

Noninvasive Blood Pressure Functions

Perform the noninvasive blood pressure (NBP) Checkout Procedure found in the Maintenance chapter. This procedure determines whether or not the NBP functions of the monitor are working as designed or whether the monitor requires NBP calibration.

If, after performing the prescribed checkout procedure, it is determined that there are potential problems that NBP calibration does not cure, try the following:

1. If calibration is unsuccessful and cannot be properly performed, there could be leaks in the pneumatic circuit plumbing. The following steps assist you in determining this.
    - The NBP cuff and tubing is the easiest area to inspect for leaks and is also the most likely area for failure in this regard. Closely inspect these items for cracks or leaks. Test the NBP cuff and tubing on a working monitor to determine the source of the problem.
    - If the NBP cuff and tubing are determined to be good after testing them on a working monitor, the leaks are probably internal to the monitor. Disassemble the monitor and check inspect all internal tubing and connections in the pneumatic circuit plumbing.

2. If no leaks are found after performing the previous step, the NBP pump assembly is suspect. Swap the NBP pump assembly with one from a working monitor and/or replace as necessary.

NBP Alarms Occur Continuously

If the monitor is not configured properly, a variety of NBP problems may occur. To determine monitor configuration, rotate then push the **Trim Knob** control to:

1. Scroll to and select *CUSTOMIZE MONITOR* from the main menu of the monitor,
2. Scroll to and select *PATIENT-MONITOR TYPE* from the customize monitor menu of the monitor.

Verify the configured monitor type matches the environment in which the monitor is being used. If it is set to a neonatal ICU when the monitor is used for the adult ICU application or vice versa, problems listed to the left may occur.

Wireless LAN Troubleshooting

Problems may occur with network communications while the monitor is communicating over Wireless LAN. Following is a list of possible solutions when troubleshooting Wireless LAN.

If the monitor can not be viewed at the central station or can not view other monitors, it may not be communicating with the internal RF card.

1. Check the status of the Wireless LAN communication:
   a. Select *REVISION AND ID* option from the Monitor Setup Menu.
   b. There are three pages of software revision information. Select *NEXT* to display the second page of information.
   c. Select *NEXT* twice to display the Hardware ID Display information window.
   d. Verify the Wireless LAN ID shows the proper country, status, revision and date code. For example: US 02 V4.63 00022.
2. If there is no Wireless LAN ID, the card may be disabled or inoperative. Verify the card is enabled:
   a. Activate the Boot Code by holding down **NBP GO/STOP** and **ZERO ALL**.
   b. Press and release the **Trim Knob** control.
   c. Keep holding **NBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
   d. Select *SERVICE MENU > SET CONFIGURATION > CONFIGURE WIRELESS LAN > ENABLE/DISABLE WIRELESS LAN*.
3. The monitor is configured with international roaming. The country abbreviation code (US 02 V4.63 00022) must match the country the monitor is in. If the code does not match:
   a. Check to make sure the correct Access Point is installed.
   b. Refer to the Wireless LAN (Symbol Access Point) Installation and Service Manual for details on proper Access Point installation.

The most common cause of non-communication is an incorrect SSID. If the communication status in the Wireless LAN ID is 01 (US 01 V4.63 00022), the RF LAN card is not communicating with the Access Point. The SSID must match the Access Point's NET ID.

1. To change the SSID status:
    a. Activate the Boot Code by holding down **NBP GO/STOP** and **ZERO ALL**.
    b. Press and release the **Trim Knob** control.
    c. Keep holding **NBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
    d. Select *SERVICE MENU > SET CONFIGURATION > CONFIGURE WIRELESS LAN >CHANGE SSID.*

    NOTE

    For all standard installations, the SSID should be GEMS (default).

2. If the status is 02, the RF LAN card is communicating with the Access Point and the network should be available.
    a. Check the network connection to the Access Point.
    b. Refer to the Wireless LAN (Symbol Access Point) Installation and Service Manual for details on proper Access Point installation.

Intermittent communication may be caused if the monitor is out of range or there is RF interference.

- If the monitor is out of range, add additional Access Points to extend the coverage area.
- If there is RF interference, the source of the interference must be removed or shielded.

Service Tips

Fault/Symptom Analysis

This information is provided for the benefit of service technicians responsible for the maintenance and repair of the monitor. The symptoms covered in this part of the Troubleshooting section represent only a select number of faults that you may encounter and by no means are intended to cover every possible failure that may occur.

A systematic approach to the diagnosis of problems as well as a general understanding of the architecture, both hardware and software, of the monitor are essential to ensure successful troubleshooting of this device. The manufacturer recommends formal service training before repairs are attempted on the monitor. The Service Tips listed below combined with formal training should provide the service technician with skills necessary to service and repair a monitor, in the event of a malfunction.

Problem	Reason	Solution
General Problems		
The unit is plugged in, but it does not switch to AC from Battery power.	■ The output voltage of the power supply is inadequate for the processor PCB to recognize.	■ Replace the power supply. ■ Replace the processor/power management assembly.
Audio Problems		
Audio does not sound.	■ The speaker cable is loose or disconnected.	■ Restore the cable connections.
Go to the Alarm Help Menu and select “Crisis.” Listen for the three-beep audio.	■ The speaker failed. ■ The audio circuit on the processor PCB failed.	■ Replace the speaker. ■ Replace the Replace the processor/power management assembly.
Optional Writer Problems		
No paper comes out, even though “Graphing” is displayed.	■ Graph locations are set incorrectly.	■ With the **Trim Knob** control, select *MONITOR GRAPH SETUP*, and *GRAPH LOCATION*. Verify that MANUAL, ALARM, and PRINT locations are set properly.
Paper comes out, but no graph data is shown.	■ The paper may be loaded incorrectly. ■ Print head may be dirty or defective.	■ Refer to the Operator Manual for correct paper installation. ■ Clean the printhead. Refer to Chapter 4, “Maintenance” ■ Perform a graph test. If problem persists, replace the writer assembly.
Saving Message	■ Writer is busy. ■ Writer is no longer available.	■ When the graph is complete, the saved graph prints out. ■ Check the graph locations. Set the correct graph locations if necessary.
Missing segments in the graph data.	■ Print head may be dirty or defective.	■ Clean the printhead. Refer to Chapter 4, “Maintenance” ■ Perform a graph test. If problem persists, replace the writer assembly.

Problem	Reason	Solution
Optional Alarm Light Indicator		
The red or yellow lights do not light on boot up of the monitor.	■ Cable may be loose or disconnected. ■ LEDs are burned out.	■ Restore the connection. ■ Replace the alarm light assembly or PCB.
Defib Sync Problems		
"Buzz" signal comes out for ECG or BP.	■ BP is not zeroed. ■ BP is not available. ■ ECG leads fail.	■ Zero out the BP. ■ Plug in a BP cable. ■ Check patient connections.
Video Display Problems		
There are bars/strips of pixels missing on the display in rows/columns. Or only one row/column of pixels on the display is missing or never turned on. The remaining portion of the display functions properly.	■ Possible burned-out pixels.	■ Run the display tests in the boot loader. ■ Replace the display assembly.
No display	■ Display may be in standby mode. ■ Backlight inverted may be defective.	■ Press the **POWER** button. If display still does not appear within 10 seconds, replace the display assembly. ■ Replace back light inverter.
Network Connector Problems		
No network connection when a network cable is connected to the monitor's Network Connector	■ The Dash monitor is connected to a Dash Port docking station. The monitor's Network Connector is inactive when it is connected to the docking station. ■ The Dash monitor does not have the optional Unity Network option enabled.	■ Connect the network cable to the docking station's Ethernet connector. ■ Purchase and enable the Unity Network option.
Remote Control		
The remote control does not activate the display.	■ Cable or Autoport to Mport adapter connections may be loose. ■ Remote control needs to be reset. ■ Remote control is defective.	■ Restore the connection. ■ Disconnect and securely reconnect the remote control from the monitor. ■ Replace the remote control with a known good one.
Masimo SET SPO2		
Probe or module malfunction	■ Five or more consecutive hardware failures have occurred.	■ Review the input error log for Masimo failure codes.

Acquisition PCB Symptoms

Symptoms relative to patient signal acquisition such as missing parameter text and waveform(s) may be associated with acquisition PCB failure. It is important that you are able to distinguish the difference between the general format of the display, which is generated by the processor PCB, versus the patient signals and data that is associated with these patient signals, a function of data acquisition, which is generated by the acquisition PCB.

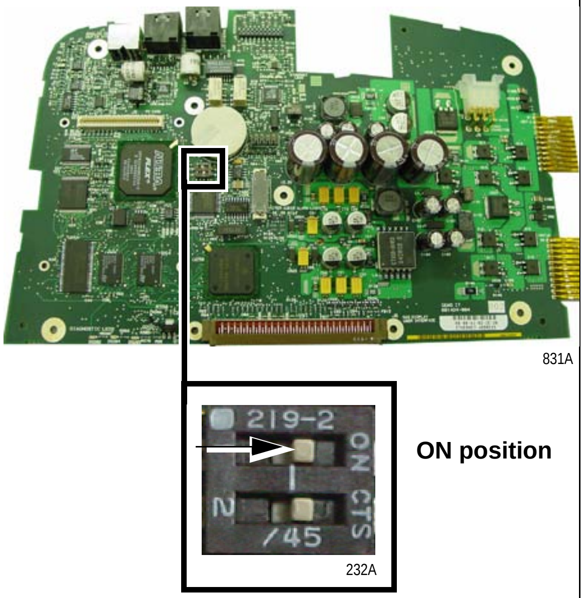
Processor PCB Symptoms

Symptoms with battery operation, network communications, asynchronous communications, NBP control, PCMCIA communications, analog output, audio/sound generation, and video signals as well as other display-related problems all may be associated with processor PCB failure. All of these are functions controlled by microcontroller or graphics processing circuitry located on the Processor/Power Management PCB.

Error Messages

The following table describes error messages that may appear on the display and how to resolve the problem.

Message	Possible Reason/Solution
“WARNING: The EEPROM data was found to be either INVALID or uninitialized. GE factory defaults will be stored in both the EEPROM and the monitor’s configuration memory. You will be required to re-enter the network configuration, re-enable any password protected features and restore all monitor settings and site-specific defaults.”	Following the EEPROM dump, restore data: 1. Restore Ethernet address and IP address as requested by the Boot Code. 2. Power cycle. 3. If error message persists, replace processor pcb. If error message no longer occurs, re-enable any password protected features and restore all monitor settings and site-specific defaults via *SERVICE MENU > Set Configuration*, and *Options Menu*.
“WARNING: THIS VERSION OF BOOT CODE IS NOT COMPATIBLE WITH THE VERSION OF MAIN CODE CURRENTLY STORED IN FLASH. PLEASE UPDATE THE BOOT CODE.”	1. Power cycle. 2. Reload Boot Code. 3. If problems persists, replace processor pcb.
“Boot Flash test FAILED.” *“ERROR: The Boot Code stored in Flash is not valid. Main Code cannot be loaded until valid Boot Code exists.”*	1. Power cycle. 2. Reload Boot Code. 3. If problems persists, replace processor pcb.
“Main Flash test FAILED.” *“ERROR: The Main Code stored in flash is not valid.”*	1. Power cycle. 2. Reload Boot Code. 3. If problems persists, replace processor pcb.
“Static RAM test FAILED.” *“ERROR: The SRAM memory test failed. Main Code will not be loaded unless this test passes. Reboot the monitor to repeat testing.”*	Replace processor pcb.
“Real Time Clock FAILED - will not start.” *“WARNING: The real time clock chip is not running. Main Code cannot be loaded until this chip is started. Attempting to start real time clock...”* Followed by either: *“The real time clock was started. Select Start Patient Monitoring to load and execute Main Code.”* Or *“ERROR: Unable to start the real time clock.”*	If problem persists and error message displays, replace processor pcb.
PREVENTIVE MAINTENANCE REQUIRED	Perform all of the maintenance procedures listed under, “Manufacturer Recommendations” on page 4-3.

Message	Possible Reason/Solution
Internal lithium battery is LOW. **NOTE** These messages are displayed while the monitor powers up. Once the “Internal lithium battery is LOW” message appears, the monitor will complete all the power-up tests. Then, after the last test is completed, the following message will be displayed on the boot loader screen. *ONE OR MORE POWER-UP TESTS HAVE FAILED ** SERVICE MAY BE REQUIRED ** DO YOU WISH TO CONTINUE MONITORING ANYWAY?* *1 = no, 2 = yes*	The processor pcb battery may be depleted. 1. Select *NO* when the message, *“ DO YOU WISH TO CONTINUE MONITORING ANYWAY?”* appears. 2. Remove this monitor from service and use a different monitor to monitor the patient. 3. Contact GE Service for lithium battery replacement instructions.
	The battery switch on processor pcb battery may be in the off position. 1. Verify that switch1 on the mini-dip switch (labeled S1) is in the ON position.  2. To move the battery switch to the ON position, complete the following steps. a. If a plastic film is over the switch, remove and discard the plastic film. b. Use a small, flat-head screw driver to move the switch to the ON position. c. Complete all of the recommended checkout, electrical safety tests, calibration tests listed in “Recommended Calibration, Electrical Safety Tests, and Checkout Procedures” on page 8-5.
	The processor pcb may be defective. ■ Refer to “Processor/Power Management PCB and Battery Assembly” on page 8-25 to replace the processor pcb.

Language-Specific Information

The following information describes differences in the Dash monitor functionality when the monitor is set to certain languages (Locale).

French Language Information

When the monitor Locale (language) is set to French_France, alarm pause duration is three minutes. Refer to “Pausing Alarms” in chapter 4 of the operator’s manual.

Czech, Hungarian, Polish, or Russian Language Information

Special characters within alarm broadcasts, messages, patient name, site name, or location fields that are sent over the optional Unity network cannot be displayed by equipment that does not support these languages. Special characters may appear as either blanks, asterisks, a series of square boxes, or no character is displayed at all because the ability to display Cyrillic (Russian alphabet) and special Czech, Hungarian, or Polish characters does not exist on this equipment.

Chinese and Japanese Language Information

When the monitor Locale (language) is set to Chinese or Japanese, the following conditions apply:

- Text for alarm broadcast over the optional network is in English.
- All text input is in English only (i.e., text for unit name, bed name, patient information, and custom default name).

6 Configuration

For your notes

Configuring a Monitor

This section explains how to configure a patient monitor. The procedure addresses use in both types of patient monitoring system configurations:

- Stand-alone patient monitor: The monitor is not interconnected to other patient monitoring system devices, and
- Networked patient monitor: The monitor is interconnected to other patient monitoring system devices for the sake of sharing patient data.

NOTE

The Unity Network is a purchased option.

The following procedure explains how to configure a patient monitor on the Unity Network. The monitor communicates with central stations, and other related equipment over the Unity Network. This network is essentially an Ethernet implementation.

General

Use this procedure if you are:

- experiencing communication problems on the Unity Network, or
- adding a new monitor to the Unity Network.

Gather Information

To configure a new monitor, you must first:

- know that the new monitor’s software revision is compatible with the other monitors connected to the Unity Network.
- write down the exact care unit name from the upper left hand corner of the central station.
- write down the bed name for the new monitor.
- know if the monitor will be used for either stationary or ambulatory (telemetry) monitoring or both.
- know if the monitor will be moved from one Ethernet connection to another.

Select Procedures

Choose and program the monitor settings listed below in the order presented. Each procedure is described on the next pages.

Main Menu Selections

- Set Unit Name
- Set Bed Number
- Patient-Monitor Type
- Set Graph Locations
- Admit Menu

Boot Code Selections

- Defib Sync Voltage
- Defib Sync Pulse Width
- Line Frequency
- CIC Protocol
- QS Protocol
- MUSE Protocol
- Transcutaneous Pace Blank Length
- Country Selection
- Configure Wireless LAN
- Set Language
- AFIB Identification
- IntelliRate
- Analog Out Buzz

After completing all necessary procedures, perform the “Checkout Procedure” found in Chapter 4, Maintenance.

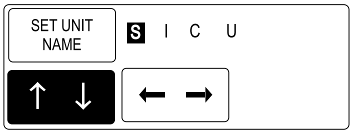
Main Menu Selections

Set Unit Name

Up to seven characters are used to identify the care unit. These characters display at the top right of the screen immediately preceding the bed number.

Access Set Unit Name option, starting from the Main Menu.

1. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407)
3. Select *MONITOR SETTINGS > UNIT NAME.*



040A

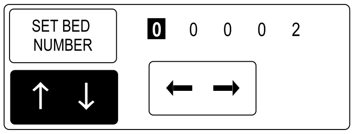
4. Use the **Trim Knob** control to select and change each character. Up to seven characters may be entered.
5. Select *SET UNIT NAME* and press the **Trim Knob** control to exit.

Set Bed Number

The bed number identifies a particular patient bed. Up to five characters are used to identify bed number. This number displays at the top right of the screen.

Access Set Bed Number option, starting from the Main Menu.

1. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407)
3. Select *MONITOR SETTINGS > UNIT NAME > SET BED NUMBER.*



041A

4. Use the **Trim Knob** control to select and change each character. Up to five characters may be entered.
5. Select *SET BED NUMBER* and press the **Trim Knob** control to exit.

Patient-Monitor Type

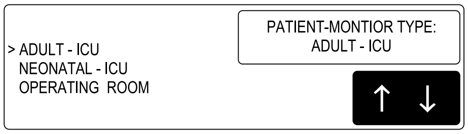
The Patient-Monitor Type selection determines the type of monitor desired, i.e., adult, neonatal or operating room. Different alarms and parameters are activated for each selection. This menu item is part of the SERVICE MODE menu.

CAUTION
Each time the patient-monitor type is changed, the *ADMIT MENU* function defaults to STANDARD configuration. Be aware that some alarms and parameters may be changed.

NOTE
The keypad/remote control is DIDCA programmed for specific monitor types. The error message, "*WARNING: REMOTE MISMATCHED WITH MONITORING MODE"* displays if the monitor and keypad/remote control do not match.

Access Patient-Monitor Type option, starting from the Main Menu.

1. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407)
3. Select *PATIENT-MONITOR TYPE*. Be sure to read the information in the Attention box before changing anything.



PATIENT-MONTIOR TYPE:
ADULT - ICU

042A

4. Rotate **Trim Knob** control to select the type of environment the monitor will be used in.
5. Press **Trim Knob** control to exit. Your selection displays at the top of the screen after the time.

Set Graph Locations

Access Manual Graph Location option, starting from the Main Menu.

1. Select *MORE MENUS > MONITOR SETUP > GRAPH SETUP > GRAPH LOCATION > MANUAL GRAPH LOCATION*.
2. Using the **Trim Knob** control, choose the manual graph location from the list.
3. Select *ALARM GRAPH LOCATION*.
4. Using the **Trim Knob** control, choose the alarm graph location from the list.
5. Select *PRINT WINDOW LOCATION*.
6. Using the **Trim Knob** control, choose the print window location from the list.
7. Select *12 LEAD PRINT LOCATION*.
8. Using the **Trim Knob** control, choose the 12 lead print location from the list.

Communication Confirmation

Confirm communication across the network.

1. Admit and generate a waveform at the monitor with a simulator.
2. Press **GRAPH GO/STOP** and observe graph output at chosen locations.

Problems?

If the writer or printer does not graph:

- Ensure the writer or printer is turned ON.
- Check all cables for a good connection.
- Check programmed alarms and manual graph locations at the monitor.

If you do not have a waveform at the central station:

- Ensure the central station software is compatible.
- Check all cables for a good connection.
- Check the programmed alarms and manual graph locations at the monitor.
- Ensure the care unit name is the same in the monitor and in the central station.
- Ensure the internet protocol (IP) addresses are programmed correctly.

Admit Menu

The Admit Menu selection determines the function of the monitor. This menu item is part of the Service Mode menu.

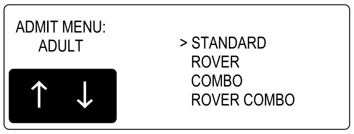
Before programming the Admit Menu, you must know if the monitor will be used for standard adult, neonatal, or operating room monitoring, and if the monitor will be moved from room to room. All combinations are explained below.

- Standard—configures the monitor to stay in one room for stationary monitoring only. Monitors not connected to the Unity Network (Ethernet connection) must use STANDARD configuration only.
- Rover—configures the monitor to move from room to room for stationary monitoring only.
- Combo—configures the monitor to stay in one room for both stationary and ambulatory (telemetry) monitoring. This monitor displays all Tram module data combined with ECG data for ambulatory patients.

NOTE
Users should be aware of a possible time discrepancy between the waveforms from the Telemetry device and the waveforms hard-wired to the Dash monitor. Users should not consider these waveforms to be synchronous. If absolute synchronicity is desired, Combo mode should be discontinued and the ECG waveforms should be acquired via the hard-wired bedside monitor.

- Rover Combo—configures the monitor to move from room to room for both stationary and ambulatory (telemetry) monitoring.

1. Access Admit Menu option, starting from the Main Menu. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407)
3. Select *MENU SETUP > ADMIT MENU.*



ADMIT MENU:
ADULT

4. Use the **Trim Knob** control to select the function of the monitor.
5. Press **Trim Knob** control to exit.

Boot Code Selections

Set Defib Sync Voltage and Pulse Width

The monitor controls the analog out signal used to trigger a defibrillator. Refer to the defibrillator manufacturer's manual for the required pulse amplitude and duration.

Use the Boot Code Service Menu to configure or change the Marker Out signal of the **DEFIB SYNC** connector.

1. Activate the Boot Code.
    a. Hold down **NBP GO/STOP** and **ZERO ALL**.
    b. Press and release the **Trim Knob** control.
    c. Keep holding **NBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
2. Select *SERVICE MENU.*
3. Select *SET CONFIGURATION* menu option.
4. In the Configuration Menu, select:
    - ◆ *1 Defib Sync Voltage:* and choose *5V* or *12V* amplitude.
    - ◆ *2 Defib Sync Pulse Width:* and choose *10 ms* or *100 ms* for pulse duration.
5. Select *Exit* and wait for the monitor to display the message, *"Writing settings to EEPROM..."*
6. Manually reboot the monitor to implement this change.

Set Line Frequency

Use the Boot Code Service Menu to configure or change the monitor line frequency to 50 or 60 Hz. The default is 60 Hz.

1. Activate the Boot Code.
    a. Hold down **NBP GO/STOP** and **ZERO ALL**.
    b. Press and release the **Trim Knob** control.
    c. Keep holding **NBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
2. Select *SERVICE MENU.*
3. Select *SET CONFIGURATION* menu option.
4. Select *Line Frequency* then choose 50 Hz or 60 Hz line frequency.
5. Select *Exit* and wait for the monitor to display the message, *"Writing settings to EEPROM..."*
6. Manually reboot the monitor to implement this change.

Set CIC and QS Protocol

The CIC and QS Protocol default setting is Seg50/51 (Segment 50/51) and should not be changed. However, future products may require Hilltop protocol. Use the Boot Code Service Menu to change the CIC Protocol and QS Protocol.

Set MUSE Protocol

The monitor transmits 12SL and ACI-TIPI data over the optional Unity Network to the MUSE and ST Guard. The formats used for this process are Hilltop and Segment 50/51. Since the Segment 50/51 format does not support 500 Hz ECG data or ACI-TIPI, records originally stored on the MUSE in Hilltop format cannot be displayed at the ST Guard.

Use the Boot Code Service Menu to set the MUSE Protocol. The default setting is Hilltop.

1. Activate the Boot Code.
   a. Hold down **NBP GO/STOP** and **ZERO ALL**.
   b. Press and release the **Trim Knob** control.
   c. Keep holding **NBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
2. Select *SERVICE MENU*.
3. Select *SET CONFIGURATION* menu option.
4. Select *MUSE Protocol* then choose *Hilltop* or *Seg50/51*.
   - Hilltop—Sends 12SL records to the MUSE in Hilltop format. The 12SL records contain 500 samples per second of ECG data. ST Guard will NOT be able to retrieve 12SL records stored on the MUSE in Hilltop format.
   - Seg50/51—Sends 12SL records to the MUSE in Segment 50/51 format with MAC Rhythm statements. The 12SL records stored on the MUSE contain 240 samples per second of ECG data. ST Guard can retrieve 12SL records from the MUSE. ACI-TIPI data can NOT be retrieved at the MUSE if this protocol is selected.
5. Select *Exit* and wait for the monitor to display the message, *"Writing settings to EEPROM..."*
6. Manually reboot the monitor to implement this change.

NOTE

Before you are able to transmit data to the MUSE and ST Guard, you must use the Service Mode menu to set up the MUSE system's Location ID and Site Number. Refer to "Access the Service Mode" on page 5-5 and to "MONITOR SETTINGS" on page 5-7.

Transcutaneous Pace Blank Length

This menu option is reserved for future use and should not be changed.

Set Country Selection

Select *DEFAULT* or *FRANCE* to choose a particular set of GE factory defaults.

1. Activate the Boot Code.
    a. Hold down **NBP GO/STOP** and **ZERO ALL**.
    b. Press and release the **Trim Knob** control.
    c. Keep holding **NBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
2. Select *SERVICE MENU*.
3. Select *SET CONFIGURATION* menu option.
4. In the Configuration Menu, select *Country Selection* and choose language.
5. Select *Exit* and wait for the monitor to display the message, *"Writing settings to EEPROM..."*
6. Manually reboot the monitor to implement this change.

Configure Wireless LAN

Confirm the configuration of the optional Wireless LAN.

1. Activate the Boot Code.
    a. Hold down **NBP GO/STOP** and **ZERO ALL**.
    b. Press and release the **Trim Knob** control.
    c. Keep holding **NBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
2. Select *SERVICE MENU*.
3. Select *SET CONFIGURATION* menu option.
4. In the Configuration Menu, select *Configure Wireless LAN to Change SSIDs* and *Enable/Disable Wireless LAN*.

    NOTE

    Do not change the SSID. Enable the Wireless LAN option if the monitor has been upgraded to with Wireless LAN.

5. Select *Exit* and wait for the monitor to display the message, *"Writing settings to EEPROM..."*
6. Manually reboot the monitor to implement this change.

Set Language

Select *Set Language* to change the language of the displayed text.

1. Activate the Boot Code.
    a. Hold down **NBP GO/STOP** and **ZERO ALL**.
    b. Press and release the **Trim Knob** control.
    c. Keep holding **NBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
2. Select the *SERVICE MENU*.
3. Select the *SET CONFIGURATION* menu option.
4. Select the *SET LANGUAGE* menu option.
5. Select the appropriate language.
6. Select *Exit* and wait for the monitor to display the message, *"Writing settings to EEPROM...*"
7. Manually reboot the monitor to display the new language.

Enable/Disable AFIB Identification

Select *AFIB Identification* to enable or disable the atrial fibrillation detection feature. This feature is part of the Cardiac software option.

1. Activate the Boot Code.
    a. Hold down **NBP GO/STOP** and **ZERO ALL**.
    b. Press and release the **Trim Knob** control.
    c. Keep holding **NBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
2. Select the *SERVICE MENU*.
3. Select the *SET CONFIGURATION* menu option.
4. Select the *AFIB Identification* menu option.
5. Select *enabled* to activate this option, or *disabled* to deactivate this option.
6. Select *Exit* and wait for the monitor to display the message, *"Writing settings to EEPROM...*"
7. Manually reboot the monitor to implement this change.
8. Verify the option has been enabled on the monitor.
    - ◆ Select the following menu options: *MORE MENUS > MONITOR SETUP > SOFTWARE CONFIGURATION.*
    - ◆ Verify that *ATRIAL FIB* is listed under *"ENABLED SOFTWARE OPTIONS."*
9. Refer to the Patient Monitoring Addendum for the DASH® 3000/4000 Operator's Manual to configure the monitor to use this feature.

Enable/Disable IntelliRate

Select *IntelliRate* to enable or disable the IntelliRate heart rate calculation feature.

1. Activate the Boot Code.
   1. Hold down **NBP GO/STOP** and **ZERO ALL**.
   2. Press and release the **Trim Knob** control.
   3. Keep holding **NBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
2. Select the *SERVICE MENU*.
3. Select the *SET CONFIGURATION* menu option.
4. Select the *IntelliRate* menu option.
5. Select *enabled* to activate this option, or *disabled* to deactivate this option.
6. Select *Exit* and wait for the monitor to display the message, *"Writing settings to EEPROM..."*
7. Manually reboot the monitor to implement this change.
8. Verify the option has been enabled on the monitor.
   1. Select the following menu options: *MORE MENUS > MONITOR SETUP > SOFTWARE CONFIGURATION*.
   2. Verify that *ECG INTELLIRATE* is listed under *"ENABLED SOFTWARE OPTIONS."*
9. Refer to the Patient Monitoring Addendum for the DASH® 3000/4000 Operator's Manual to configure the monitor to use this feature.

Analog Out Buzz

Select *Analog Out Buzz* to identify an ECG or an invasive BP “leads off” condition via a supported analog out device. The default is 0 volts.

1. Activate the Boot Code.
    - a. Hold down **NBP GO/STOP** and **ZERO ALL**.
    - b. Press and release the **Trim Knob** control.
    - c. Keep holding **NBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
2. Select the *SERVICE MENU*.
3. Select the *SET CONFIGURATION* menu option.
4. Select the *Analog Out Buzz* menu option.
5. Select *60Hz sine wave* to display a 60 Hz sine wave, or select *0 volts* to diaplay a flat line.
6. Select *Exit* and wait for the monitor to display the message, *“Writing settings to EEPROM...”*
7. Manually reboot the monitor to implement this change.

Completion

The monitor is now ready for normal operation. At this time, perform the “Checkout Procedure” found in Chapter 4, Maintenance.

Advanced User Procedures

The following procedures are for advanced users only. These procedures should rarely be used, and only experienced technicians should proceed.

Procedures

The following procedures are discussed later in this chapter.

- Set Time and Date
- Transfer Monitor Defaults
- Change Ethernet Address
- Set Internet Address
- Reviewing Error Logs
- Transferring Error Logs
- Reviewing Event Logs

Set Time and Date

Change the time only when the system is switched to or from daylight savings time.

NOTE

When a monitor is first connected to the optional Unity Network, the time and date is automatically updated from the network time.

WARNING

Loss of patient data history. Changing the time or date settings may result in the loss of patient data history. If one monitor's time or date is changed, all monitors on the network "listen" and follow suit within 3-5 seconds. Changing the time base of one monitor may cause some loss of patient data history for all the monitors on the network.

The following procedure explains how to use the TIME AND DATE option in the monitor SERVICE MODE menu.

1. Access the Time and Date menu starting from the Main Menu. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407)
3. Select *SET TIME* and use the **Trim Knob** control to change the time. The time displays as a 24-hour military clock.
4. Select *SET DATE* and use the **Trim Knob** control to change the date.

Transfer Monitor Defaults

NOTE

Transfer Monitor Defaults feature is part of the Unity Network software option and is available in software version 3 or later. You must purchase and enable this software option before you can transfer monitor defaults.

The monitor defaults set on one monitor (server) may be transferred to another monitor (client), provided that the client monitor shares the following:

- the same software revision (version),
- the same patient-monitor type (i.e. ADULT, NEO, or OR),
- the same software package (i.e. Basic, Cardiac, Cardiopulmonary), and
- the same country code (i.e. Default or France).

The following defaults transfer when using this feature:

- all monitor defaults
- custom default names
- 12 SL location
- 12 SL site

Store Monitor Defaults for Transfer

To transfer monitor defaults, they must be set, then stored on the monitor that is used as the server.

1. At the server monitor, set up the monitor defaults you want to store. Refer to the following sections of the “Dash 3000/4000 Patient Monitor Operator’s Manual” for reference:
    - ◆ Defaults Worksheet located in the preface of the manual. These are blank and allow you to enter your own default settings.
    - ◆ Monitor Setup chapter.
    - ◆ Adult ICU, Neonatal ICU, Operating Mode Factory Default Appendices.
2. When defaults are set, start from the Main Menu and select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
3. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407)
4. Select *MONITOR SETTINGS.*
5. Select *STORE DEFAULTS FOR NETWORK TRANSFER.*
6. Select *YES* to the confirmation popup menu.

Copy Stored Monitor Defaults

WARNING
Loss of Defaults. Copying monitor defaults from the server monitor erases all of the monitor defaults on the client monitor.

To copy monitor defaults from the server monitor, the client monitor must be in the Discharged state. If the client monitor is set to the OR patient-monitor type, it must not be in Combo or Rover Combo Admit mode.

NOTE

Make sure that the client monitor shares the same configuration as the server monitor. Refer to "Transfer Monitor Defaults" on page 6-16.

1. At the client monitor, start from the Main Menu and select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407)
3. Select *COPY UNIT DEFAULTS*.
4. Select *SELECT UNIT TO COPY MONITOR DEFAULTS FROM.*
5. From the list of units on the Unity network, choose the unit the server monitor is in.
6. Select *SELECT BED TO COPY MONITOR DEFAULTS FROM.*
7. Scroll through the list of beds within the selected unit until the desired server monitor is found. Select it, and answer *YES* to the confirmation popup menu.

NOTE

After copying monitor defaults, the first set of defaults is automatically activated. If another set of defaults is desired, the user must manually select it from the Recall Defaults menu.

After copying monitor defaults from another bed (the server monitor), verify that the defaults were transferred and arrhythmia levels are as desired.

Troubleshooting Monitor Defaults Transfer

Below is a list of error messages that may display when performing a monitor defaults transfer.

Storing Monitor Defaults

Message	Description
ERROR - UNIT DEFAULTS HAVE NOT BEEN SAVED	Monitor defaults were not saved on the server monitor due to a memory error in the monitor.

Copying Stored Monitor Defaults

Message	Description
ERROR COPYING UNIT DEFAULTS - NETWORK ERROR	Either an error has occurred while the defaults were being transferred, or defaults have not been saved on the server monitor.
ERROR COPYING UNIT DEFAULTS - UNIT TYPE MISMATCH	The server and client monitors are set to different unit types (i.e. ADULT, NEO, or OR)
ERROR COPYING UNIT DEFAULTS - SOFTWARE VERSION MISMATCH	The server and client monitors have different software versions (i.e. V2C, V3A).
ERROR COPYING UNIT DEFAULTS - DATA CORRUPTION ERROR	The monitor defaults transferred have become corrupted, possibly due to a memory error.
ERROR COPYING UNIT DEFAULTS - SOFTWARE FEATURE LEVEL MISMATCH	The server and client monitors are set to different software levels (i.e. Basic, Cardiac, Cardiopulmonary).
ERROR COPYING UNIT DEFAULTS - COUNTRY CODE MISMATCH	The server and client monitors are set to different country codes (i.e. *DEFAULT* or *FRANCE*).

Change Ethernet Address

The Ethernet address is an identification number assigned to each device on the optional Unity Network. It must be done in Boot Code using a unique password only if it has been corrupted. Contact your sales/service representative and provide them with the serial number and Ethernet address of the unit to obtain a password.

WARNING
Lost Data. Duplication of an Ethernet address on a network will cause lost data. If you change the factory-assigned Ethernet address, you must first record all *other* Ethernet addresses used on your network to avoid duplication.

Activate the Boot Code program as follows:

1. Hold down **NBP GO/STOP** and **ZERO ALL** on the front panel.
2. Press and release the **Trim Knob** control.
3. Keep holding **NBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
4. Select *Service Menu* > *Option Menu* > *Change Ethernet Address*.

Review Errors

This procedure describes how to review the error logs of a monitor. If the Unity Network software option is enabled, the error logs may also be transferred over the network to a central station and copied onto diskette for further review or sent to GE personnel for review. The transferring procedure “Copying Error Log Files” is described later in this chapter.

WARNING
This procedure is intended for use by service personnel with advanced troubleshooting skills.

Some of the information recorded in the error logs is useful for field troubleshooting. The details included here serve as an introduction to the error logs and provide basic information about what you can learn from them.

1. Access Review Errors starting from the Main Menu. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407)

3. Select *REVIEW ERRORS*.

The menu provides four error log choices, two for viewing error logs and two for clearing the error logs.

View Output/Input Errors

1. Select *VIEW OUTPUT ERRORS* or *VIEW OUTPUT ERRORS* to view one error in the log of errors.

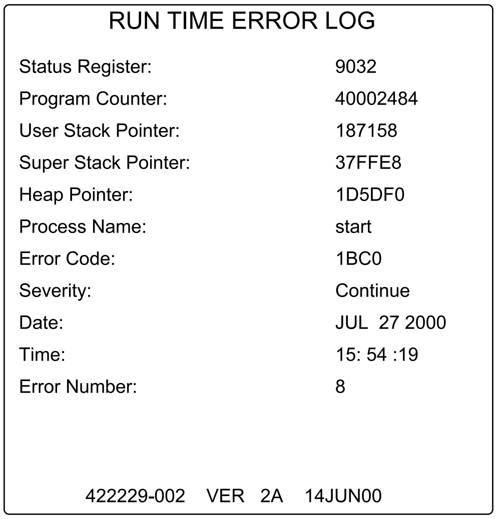
   The error log in a monitor holds 50 errors that can be accessed with the Next or Previous command. The errors display one error at a time in the upper right corner of the screen. Watch the error number category to keep track of which error you are viewing.

   The View Output Errors provides a list of output software errors; the View Input Errors provides a list of input software errors.

2. To clear all the errors in the error log, select *CLEAR OUTPUT ERRORS* or *CLEAR INPUT ERRORS* menu option. Be aware that once the clear menu option is executed, all selected errors in memory are erased.

Useful Error Data

Below is sample error log followed by a description of parameters found in the error log.



```
              RUN TIME ERROR LOG

Status Register:                    9032
Program Counter:                    40002484
User Stack Pointer:                 187158
Super Stack Pointer:                37FFE8
Heap Pointer:                       1D5DF0
Process Name:                       start
Error Code:                         1BC0
Severity:                           Continue
Date:                               JUL  27 2000
Time:                               15: 54 :19
Error Number:                       8



        422229-002    VER   2A    14JUN00
```

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Process Name

The name of the software task that was operating when the event/ problem occurred.

Error Code

The error log contains more than just operating system errors. Many events that have an impact upon the system are also entered into the log.

The 700-series of error codes are really system-initiated events. Listed below are some of the event/error codes you might find useful.

Definition of Error Codes	
Error Code	Description
400-4FF	Network errors were detected.
703	Diagnostic tests were completed.
70B	Internet address was changed. The network address for the monitor was changed. This should only be done by qualified service personnel.
70C	Video test was completed. This test should only be performed by qualified service personnel.
70E	Time was changed from this monitor. This helps determine how the system-wide time may have been altered.
70F	Date was changed from this monitor. This helps determine how the system-wide date was altered.
710	Incompatible software was detected. If the main processor software finds that the software operating on the communication software incompatible, it turns off the communication (network) controller and enters this data into the error log. When the monitor won’t “talk” to the network, looking for this entry in the error log is one part of the troubleshooting process.

NOTE

The monitor may be referred to as a display or scope in the error code descriptions.

Severity

Severity is a measure of how the event/error affected the system. There are three levels of severity.

- Continue—the event/error was logged, the task may have or may not have been finished, but the system was able to go on. Most log entries will have a severity of Continue.
- Fatal—the event/error was such that the task is not able to go on. Recovery was not possible. This always is followed by a WARM START.
- Forced Restart—the system was restarted by a known condition (internet address change, video test, etc).

Date and Time

The date and time the event/problem occurred.

Error Number

A sequential number that is used to identify each event/problem.

Transferring Error Logs

General

NOTE

The Unity Network software option must be enabled before the error logs may be transferred over the network to a central station.

The following procedure describes how to copy the patient monitor and parameter module error logs and then transfer them to a diskette at the Centralscope central station. To transfer error files from a Clinical Information Center (CIC), refer to the GE Prism Information Field Service Manual.

A Centralscope or CIC central station can perform normal patient data display tasks and act as a remote terminal. The remote terminal function is useful for retrieving, viewing, and saving error logs from any GE patient monitoring equipment communicating on the Unity Network. Through a series of menus, a device such as a monitor, another central station, or parameter module, can be selected in any Care Unit. Then a device error log for a particular day may be chosen.

Once the desired error log is selected it can be copied over the network to a floppy diskette in the central station's floppy diskette drive. Since the error logs are text files they can be read into other computers and using most text editors or word processing applications.

Use the following procedure to transfer error files from a Centralscope central station.

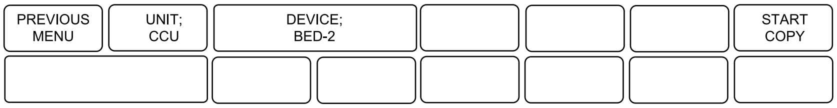
CAUTION

This procedure is intended for use by service personnel with advanced troubleshooting skills. Do not "experiment" with these commands! The consequences of misuse include loss of patient data, corruption of the central station operating software, or disruption of the entire Unity Network.

Access the *COPY LOGS* Menu

1. Beginning with the Centralscope central station Main Menu, select *CENTRAL SETUP > SERVICE*.
2. Enter password: **MEI CS 123**
3. Select *COPY LOGS*. The Copy Logs menu displays.

4. Select the Care Unit.


PREVIOUS MENU
UNIT; CCU
DEVICE; BED-2
START COPY

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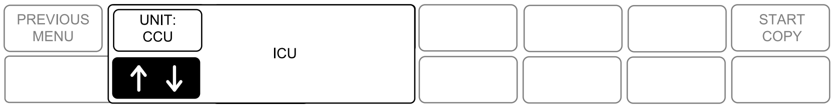
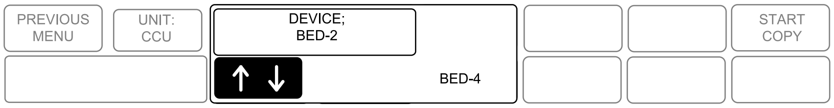
5. Select *UNIT:*
6. Using the **Trim Knob** control, change the displayed Care Unit name. When the desired Care Unit name displays, press the **Trim Knob** control.


PREVIOUS MENU
UNIT: CCU
ICU
↑ ↓
START COPY

044A

Select the Monitoring Device

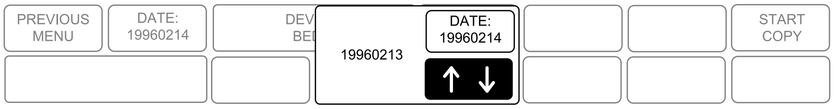
1. Select *DEVICE:*
2. Using the **Trim Knob** control, change the displayed device name. Note that only monitoring devices within the previously selected Care Unit show. When the desired monitoring device name displays, press the **Trim Knob** control.


PREVIOUS MENU
UNIT: CCU
DEVICE; BED-2
↑ ↓
BED-4
START COPY

045A

Select the Error Log Date

1. Select *DATE:*
2. Using the **Trim Knob** control, change the error log date. Note that one of the selections is *ALL*, which retrieves all stored error logs from the specified device. When the desired date displays, press the **Trim Knob** control.

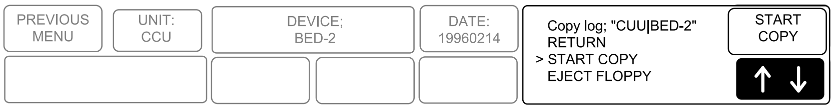

PREVIOUS MENU
DATE: 19960214
DEV
BE
19960213
DATE: 19960214
↑ ↓
START COPY

046A

Copy Error Logs

Once the Care Unit, device, and date have been specified the final step is to begin copying the error logs to the floppy diskette.

1. Insert a PC-formatted, high-density floppy diskette into the floppy diskette drive of the central station.
2. Select *START COPY.* A new display appears that confirms the file source device.
3. Using the **Trim Knob** control, select the desired function. Press the **Trim Knob** control to start.



Copy log; "CUU|BED-2"
RETURN
> START COPY
EJECT FLOPPY

Once the copy function begins the Start Copy button changes to show the function: “copying.”

Eject Floppy

Select this option to eject the floppy diskette from the central station’s disk drive.

7 Calibration

For your notes

Hardware Calibration

There are NO FIELD ADJUSTMENTS or calibration for the following hardware components:

- Processor PCB
- DAS PCB
- Power Supply PCB
- Display - color
- Writer Assembly

These adjustments are set and sealed during manufacture of the component or assembly. Breaking the seal of the adjustments voids the calibration.

NBP, Analog Output ECG, Analog Output BP, and End-tidal CO2 Software Calibration

Noninvasive blood pressure (NBP), Analog Output ECG, Invasive Pressures (Analog Output BP), and End-tidal CO2 (optional) require software calibration.

Perform the NBP and End-tidal CO2 software calibration upon receipt of the equipment, every 12 months thereafter, and each time the unit is opened for service. This ensures the pneumatic circuit plumbing has not developed any air leaks as a result of disassembly. Perform the analog output ECG and analog output BP software calibration only if these did NOT pass the analog output checkout procedure.

NBP Calibration

In General

The overall accuracy of noninvasive blood pressure (NBP) readings by the monitor depend on the following:

- the zero pressure reading, and
- the voltage span of the NBP sensor in the monitor.

This procedure provides a method of verifying these items are accurate and also checks the NBP pneumatic circuit plumbing for leaks.

The manufacturer recommends performing this procedure upon initially receiving the monitor, before it is used on a patient, and once each year thereafter. Also, perform the procedure each time the monitor is opened for service or repair, simply to verify the NBP pneumatic circuit plumbing did not develop inadvertent air leaks.

Required Test Equipment

The following items are required to successfully complete the NBP calibration procedure.
Refer to “Noninvasive Blood Pressure Tests” on page 4-50 for setup guidelines.

- Voltmeter,
- Unterminated defib sync cable,
- Manometer (Sensym PDM200M or mercury manometer),
- NBP tube, pn 9461-203,
- NBP cuff, pn 9461-301 (any size works), and
- Something to wrap the NBP cuff around (PVC pipe or coffee can).

The table below lists items for connecting the NBP tube between the manometer and NBP cuff:

Description	Part Number	Qty
NBP cuff coupling	400787-001	1
NBP hose coupling	46100-002	1
NBP tee	4745-101	1
NBP tubing	401582-001	2

WARNING
When the NBP cuff is used in this procedure, it must be tightly wrapped around a rigid cylinder or pipe. DO NOT put the NBP cuff around a human arm during the calibration procedures due to the potential for injury.

Calibration Procedure

Using the **Trim Knob** control, access the Service Mode menu starting from the Main Menu.

1. Select *MORE MENUS-> MONITOR SETUP-> SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select *CALIBRATE-> CALIBRATE NBP-> CAL ZERO OFF-> START*.
4. The text on the menu item changes from Cal Zero Off to Cal Zero In Progress.

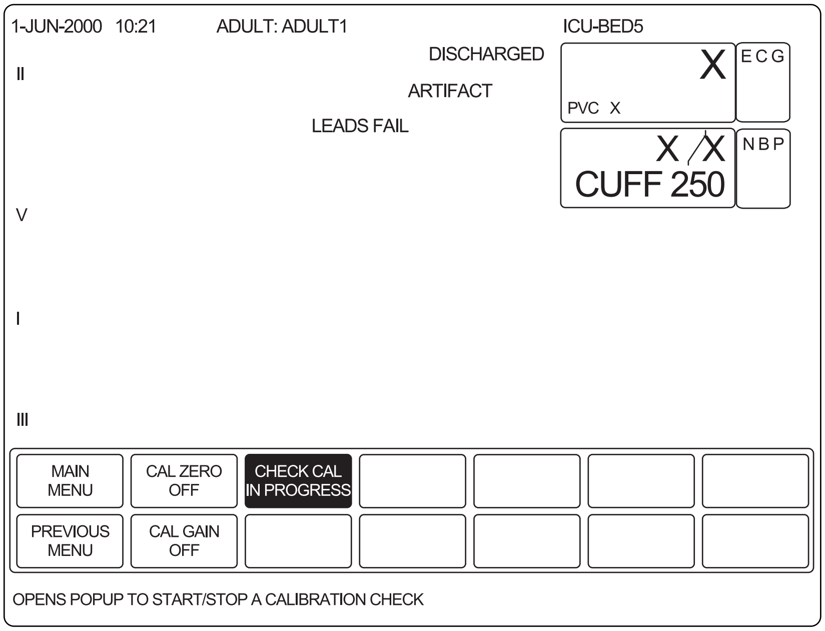
   When the process is complete, the menu item shows that it is *OFF* again.

Gain Calibration Test

NOTE
To proceed with the Gain Calibration Test, setup the monitor and test equipment following the guidelines illustrated in the NBP Checkout Procedure, Chapter 4, Maintenance.

1. Connect a cuff and manometer to the monitor.
2. Turn the digital manometer on and adjust the range switch to 1000 mmHg.
3. Select *CAL GAIN OFF-> CAL GAIN OFF-> START*.

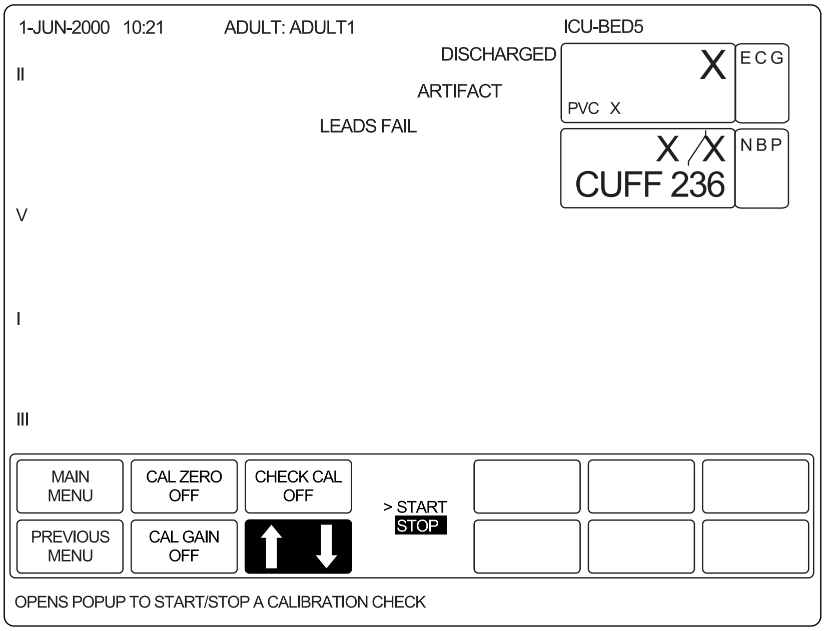
4. The second line of text on the Cal Gain menu item changes from Cal Gain Holding to Cal Gain Inflating. The monitor starts pumping up the pressure bulb or cuff—the audible whirring sound of the NBP pump motors occurs and an increase in displayed pressures on both the monitor and the manometer can be observed.
5. The pump shuts off at about 250 mmHg, and the pressure drops slowly to about 240 mmHg before stabilizing. The second line of text on the Cal Gain menu item changes from Inflating back to Holding . If the pressure continues to drop at a rate of 1 mmHg or more for every five seconds, there is a leak in the NBP plumbing. If there is a leak in the NBP plumbing, repair it and restart this calibration procedure.
6. Select *ENTER CAL PRESSURE* and use the **Trim Knob** control to select a pressure value that is 1 mmHg lower than the current manometer reading. When the manometer falls to exactly the value that you selected in the pop-up window, press the **Trim Knob** control to enter the value.
7. Select *CHECK CAL OFF-> START*.
8. The text on the menu item changes from Check Cal Off to Check Cal In Progress. Verify the pressure readings (shown as Cuff in the NBP parameter box) on the monitor and manometer are equal (± 1 mmHg) for AT LEAST one full minute.


1-JUN-2000 10:21
ADULT: ADULT1
ICU-BED5
DISCHARGED
II
ARTIFACT
LEADS FAIL
X
PVC X
E C G
X / X
CUFF 250
N B P
V
I
III
MAIN MENU
CAL ZERO OFF
CHECK CAL IN PROGRESS
PREVIOUS MENU
CAL GAIN OFF

OPENS POPUP TO START/STOP A CALIBRATION CHECK

028B

9. Select *CHECK CAL IN PROGRESS -> STOP*. The monitor automatically releases pneumatic pressure in the entire plumbing circuit.


1-JUN-2000 10:21
ADULT: ADULT1
ICU-BED5
DISCHARGED
ARTIFACT
LEADS FAIL
II
V
I
III
X
PVC X
ECG
X / X
CUFF 236
NBP
MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
> START
STOP
PREVIOUS MENU
CAL GAIN OFF
OPENS POPUP TO START/STOP A CALIBRATION CHECK
029B

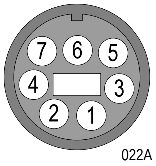
10. Unplug the monitor from AC power source and remove the test apparatus from the monitor.

ECG or BP Calibration

Before you Begin

To complete the ECG or BP calibration, you must connect a voltmeter to the monitor.

1. Attach the analog output cable (pn 2000633-001) to the monitor.
2. Connect a 5.5 digit precision voltmeter (such as HP34401A, or equivalent) to the port pin to be calibrated (If ECG: Pin 7 = ECG signal, Pin 3 = ground. If BP: Pin 6 = BP, Pin 5 = ground.).


7
6
5
4
3
2
1
022A

3. Access the monitor’s Service Mode
4. Calibrate the ECG or the BP parameters.

ECG Calibration

Using the **Trim Knob** control, access the Service Mode menu starting from the Main Menu.

1. Select *MORE MENUS-> MONITOR SETUP-> SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select *CALIBRATE-> CAL ECG ANALOG OUT-> SET ECG LOW.*
4. Adjust the count for –9.0 V ± 5 mV on the meter and press the **Trim Knob** control.
5. Select *SET ECG HIGH*.
6. Adjust the count for +9.0 V ± 5 mV on the meter and press the **Trim Knob** control.
7. Select *SET ECG ZERO*.

   Adjust the count for 0.0 V ± 5 mV on the meter and press the **Trim Knob** control.
8. Select *CONFIRM ECG CAL* to confirm or abort the calibration

BP Calibration

Using the **Trim Knob** control, access the Service Mode menu starting from the Main Menu.

1. Select *MORE MENUS-> MONITOR SETUP-> SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select *CALIBRATE-> CAL BP ANALOG OUT-> SET BP LOW.*
4. Adjust the count for –9.0 V ± 5 mV on the meter and press the **Trim Knob** control.
5. Select *SET BP HIGH*.
6. Adjust the count for +9.0 V ± 5 mV on the meter and press the **Trim Knob** control.
7. Select *SET BP ZERO*. Adjust the count for 0.0 V ± 5 mV on the meter and press the **Trim Knob** control.
8. Select *CONFIRM BP CAL* to confirm or abort the calibration

End-tidal CO_2 Calibration

To calibrate the mainstream end-tidal CO_2, refer to the CO_2 chapter in the Dash 3000/4000 Patient Monitor Operator’s Manual. To calibrate the sidestream end-tidal CO_2, refer to the documentation that came with the module.

8 Field Replaceable Units and Upgrades

Field replaceable units (FRU's) are available for some assemblies. Refer to Chapter 9, "Assembly Drawings" for part numbers.

WARNING

DAS ASSEMBLY — Do NOT open the DAS assembly as this breaks the isolation barrier which may result in patient death or serious injury. The DAS assembly is a field replaceable unit only. There are NO field repairs or adjustments for the DAS assembly.

For your notes

Disassembly Guidelines

WARNINGS

REPAIR TO THE FRU LEVEL — Field repairs are recommended to the field replaceable unit (FRU) only. Attempting a field repair on a PCB or a factory sealed component or assembly could jeopardize the safe and effective operation of the monitor.

BATTERY EXPLOSION HAZARD — When removing the GCX plate and the footpad from the bottom of the monitor, clearly identify the screws to ensure the same screws are used to replace both the footpad and the GCX plate. Do NOT re-assemble the footpad without the GCX plate. Screws that are too long will penetrate into the battery case and cause the battery to leak or to explode.

NOTE

GE recommends that you assemble the monitor using the NEW fasteners (screws, washers, etc.) provided in the Field Replaceable Unit kit. Some fasteners, like the screws with a thread locking coating, are NOT intended to be re-used more than three times.

Tools Required

A standard set of hand tools is required for disassembly and assembly.

Before Disassembly

Before you disassemble the monitor, you should ALWAYS do the following tasks.

1. Remove AC power.
2. Remove both batteries.
3. Provide appropriate electrostatic discharge protection to prevent damaging the monitor.
4. Be aware that the nonspecific disassembly instructions apply to all monitors supported by this service manual. Disassembly for specific models of the monitor are identified when required.

Hardware Assemblies

When disassembling the monitor, observe the following guidelines:

- Remove the handle assembly, then remove the display assembly to access the field replaceable or upgradeable components of the display assembly and the main unit.
- Note the positions of wires, cables, and different sized screws; marking them if necessary to ensure they are replaced correctly.

PCB Assemblies

Electrostatic Discharge (ESD) Precautions

All external connector inputs and outputs of the monitor are designed with protection from ESD damage. However, if the monitor requires service, exposed components and assemblies contained within are susceptible to ESD damage. This includes human hands, non-ESD protected work stations and/or improperly grounded test equipment.

The following guidelines help make a service workstation more resistant to the ESD damage:

- Discharge any static charge you may have built up before handling semiconductors or assemblies containing semiconductors.
- A grounded, antistatic wristband (3M part number 2046 or equivalent) or heel strap should be worn *at all times* while handling or repairing assemblies containing semiconductors.
- Use properly grounded soldering and test equipment.
- Use a static-free work surface (3M part number 8210 or equivalent) while handling or working on assemblies containing semiconductors.
- DO NOT remove semiconductors or assemblies containing semiconductors from antistatic containers (Velo-stat bags) until absolutely necessary.
- Make sure power to an assembly is turned off before removing or inserting a semiconductor.
- DO NOT slide semiconductors or electrical/electronic assemblies across any surface.
- DO NOT touch semiconductor leads unless absolutely necessary.
- Semiconductors and electrical/electronic assemblies should be stored only in antistatic bags or boxes.
- Handle all PCB assemblies by their edges.

These guidelines may not guaranty a 100% static-free workstation, but can greatly reduce the potential for failure of any electrical/electronic assemblies being serviced.

After Reassembly

After reassembling the monitor, ALWAYS complete the calibration tests, checkout procedures, electrical safety tests, and regular maintenance procedures identified and described in this manual.

Recommended Calibration, Electrical Safety Tests, and Checkout Procedures

Replacement or Upgrade Procedure	Calibration Tests	Checkout Procedures	Electrical Safety Tests
■ Alarm light option ■ Backlight inverter PCB	None	■ “Monitor Power-up Tests” on page 4-35. ■ “Display Test” on page 4-56. ■ “5 Lead ECG Test” on page 4-37. Complete Steps “1.” through “4.”	■ “Ground (Earth) Integrity” on page 4-26. ■ “Ground (Earth) Wire Leakage Current Tests” on page 4-28. ■ “Enclosure Leakage Current Test” on page 4-29. ■ “Patient (Source) Leakage Current Test” on page 4-30. ■ “Patient (Sink) Leakage Current Test (Mains Voltage on the Applied Part)” on page 4-31.
Speaker	None	Complete ALL the Checkout Procedures identified in Chapter 4, “Maintenance” .	
■ Keypad assembly ■ LCD color display	None	■ “Monitor Power-up Tests” on page 4-35. ■ “Display Test” on page 4-56.	
■ GE DAS assembly ■ Masimo DAS assembly	“NBP Calibration” on page 7-4.	■ “ECG Tests” on page 4-37. ■ “Respiration Tests” on page 4-40. ■ “Temperature Tests” on page 4-41. ■ “Cardiac Output Tests” on page 4-42. ■ “Invasive Blood Pressure Tests” on page 4-44. ■ “Pulse Oximetry Tests for GE SPO2 Oximeter” on page 4-47. Use this procedure if you installed a GE DAS assembly. ■ “Pulse Oximetry Tests for Masimo SET SPO2” on page 4-49. Use this procdure if you installed a Masimo DAS assembly. ■ “Noninvasive Blood Pressure Tests” on page 4-50. ■ Refer to the CO2 chapter in the monitor’s operator manual to checkout the mainstream End-tidal CO2. ■ To check out the sidestream End-tidal CO_2, refer to the documentation that came with the module.	
NBP assembly	“NBP Calibration” on page 7-4.	■ “Noninvasive Blood Pressure Tests” on page 4-50.	

Recommended Calibration, Electrical Safety Tests, and Checkout Procedures

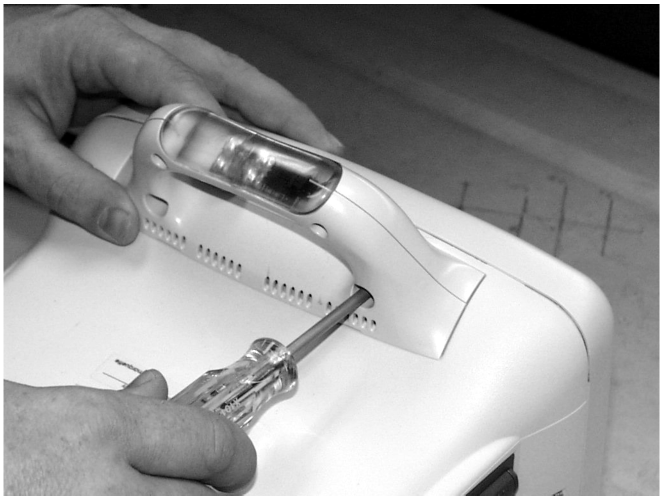
Replacement or Upgrade Procedure	Calibration Tests	Checkout Procedures	Electrical Safety Tests
RF LAN	None	■ “Monitor Power-up Tests” on page 4-35. ■ “Network Test” on page 4-57. ■ “RF LAN Test (option)” on page 4-57.	■ “Ground (Earth) Integrity” on page 4-26. ■ “Ground (Earth) Wire Leakage Current Tests” on page 4-28. ■ “Enclosure Leakage Current Test” on page 4-29. ■ “Patient (Source) Leakage Current Test” on page 4-30. ■ “Patient (Sink) Leakage Current Test (Mains Voltage on the Applied Part)” on page 4-31.
Power supply assembly	None	■ “Monitor Power-up Tests” on page 4-35. ■ “For instructions on verifying sidestream end-tidal CO2 and setting the sample line to zero, refer to the CO2 module operator instructions.” on page 4-54.	
Processor/ Power Management	ECG and BP on 7-7.	■ “Monitor Power-up Tests” on page 4-35. ■ “Analog Output and Defibrillator Synchronization Tests” on page 4-52. ■ “For instructions on verifying sidestream end-tidal CO2 and setting the sample line to zero, refer to the CO2 module operator instructions.” on page 4-54. ■ “Graph Test” on page 4-55. ■ “Graph Speed Test” on page 4-56. ■ “Display Test” on page 4-56. ■ “Speaker Test” on page 4-56. ■ “Network Test” on page 4-57. ■ “RF LAN Test (option)” on page 4-57. ■ “RAC 2A Module Housing Peripheral Device Test” on page 4-58.	
Writer (Recorder)	None	■ “Monitor Power-up Tests” on page 4-35. ■ “Graph Test” on page 4-55. ■ “Graph Speed Test” on page 4-56.	

Handle Assembly

NOTE
The alarm light is an option and may not be on your monitor.

Removing the Handle Assembly

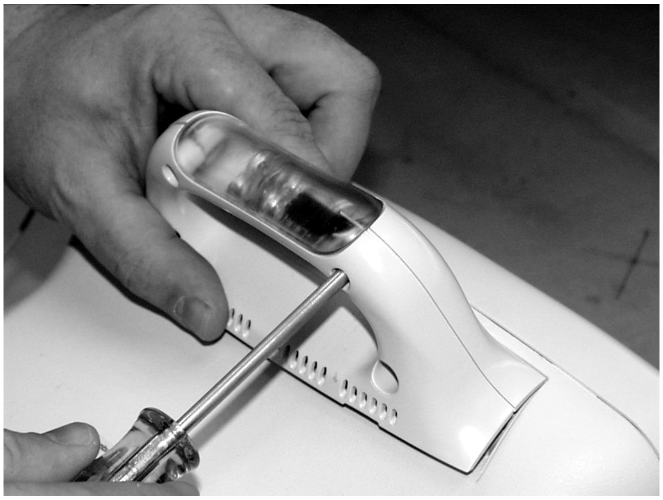
Remove the two screws holding the handle to the monitor. Take care not to strain the cables if your monitor has the alarm light option or the RF LAN option.



537A

Replacing or Upgrading the Dash 3000 Alarm Light Option

1. Remove the two screws holding the handle together.

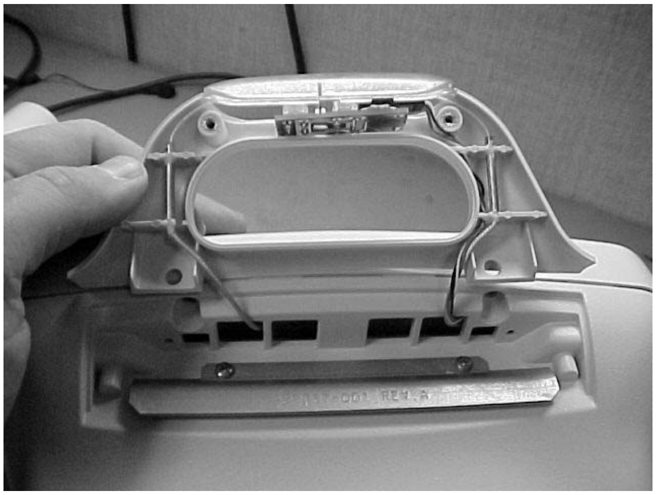


538A

2. Complete the following steps identified for your service procedure.

Alarm Light Replacement	Alarm Light Upgrade (FRU)
a. Remove the clear plastic cover. b. Disconnect the Alarm Light cable harness from the Alarm Light PCB. c. Replace the defective Alarm Light PCB.	a. Remove the blank plastic cover. b. Insert the Alarm Light PCB.

3. Connect the Alarm Light cable harness to the Alarm Light PCB and route the cables as shown.



542A

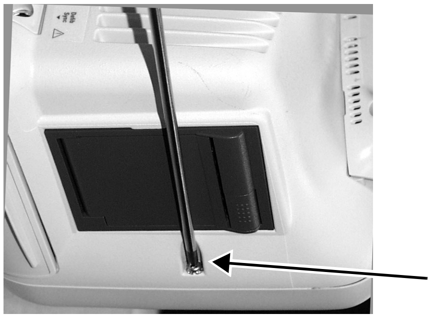
4. Replace the clear plastic cover and reassemble the handle.

Display Assembly Components

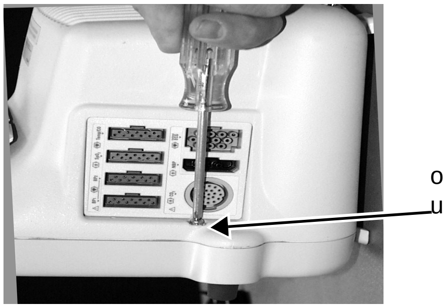
Removing the Display Assembly from the Main Unit

This procedure allows you to access the field replaceable or upgradeable components of the monitor's display assembly and the main unit.

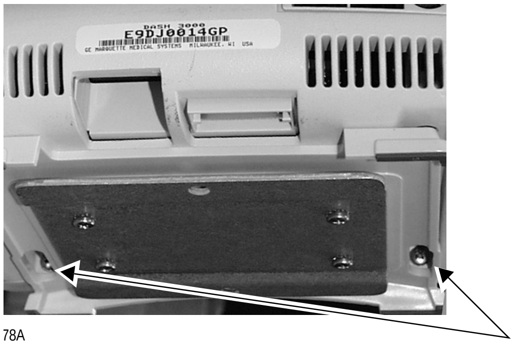
1. Remove the handle assembly from the monitor. Refer to "Removing the Handle Assembly" on page 8-7.
2. Place the monitor face down on a non-abrasive, static-free surface. Make sure the **Trim Knob** control hangs off the edge of the surface to avoid damage.
3. Remove the four screws to separate the display assembly from the main unit.


One screw on the left side of the unit...

579A


one screw on the right side of the unit...

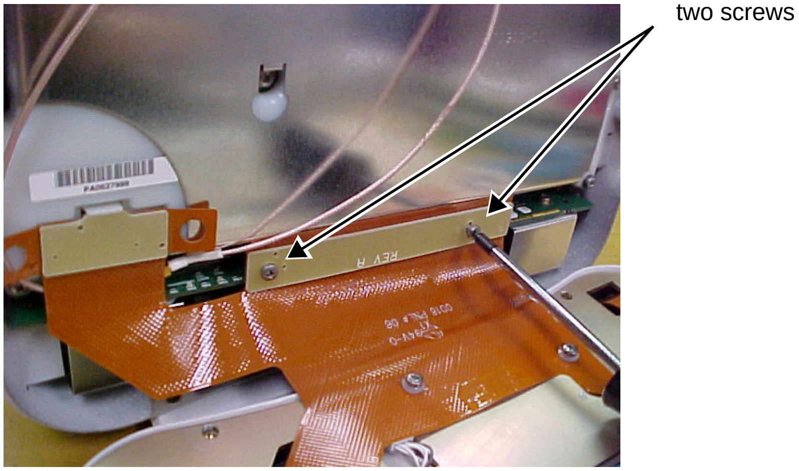
580A



...and two screws on the bottom of the unit.

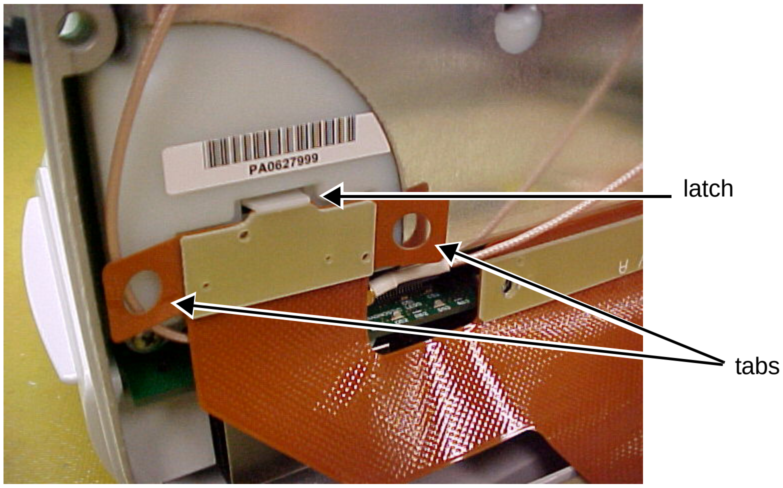
78A

4. Remove the two screws attaching the flex circuit to the main unit's processor/power management PCB. Remove the flex connector by pulling on the flex connector strain relief.



543A

5. Remove the DAS connector by lifting the snap latch and tabs.

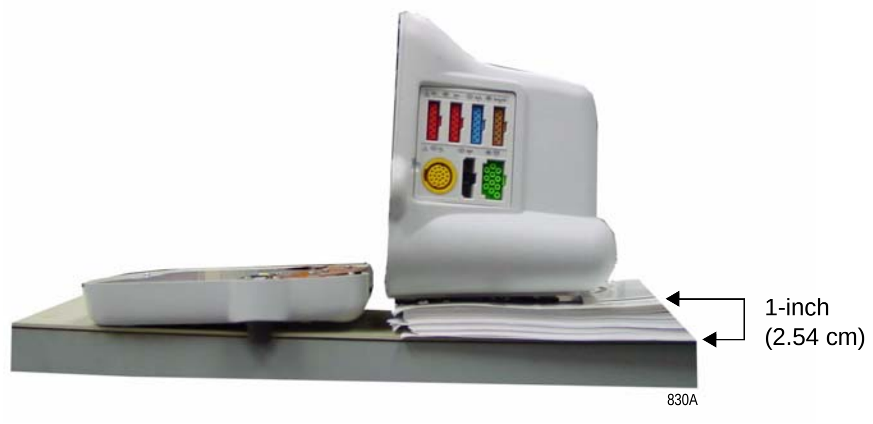


544A

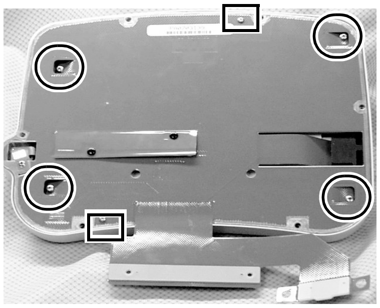
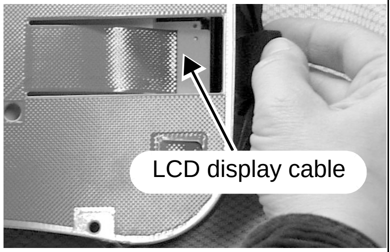
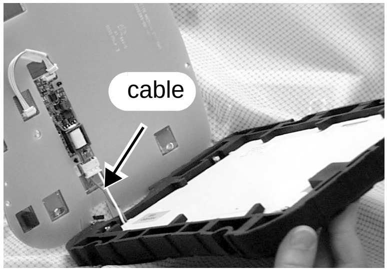
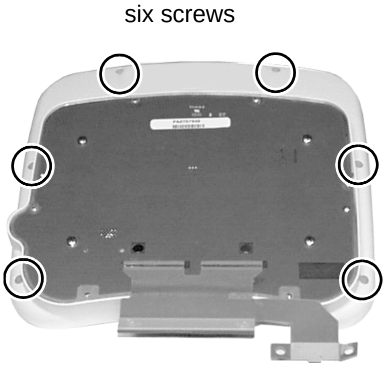
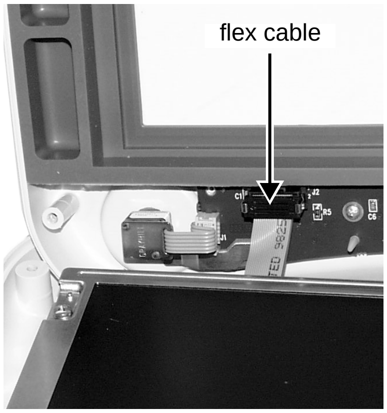
6. Place the display assembly face down on a non-static, non-abrasive surface. Make sure the **Trim Knob** control hangs off the edge of the surface to avoid damage.

NOTE

When re-assembling the monitor, the display flex could be over-flexed and damaged when you re-connect the display flex to the main unit. To reduce the potential of damaging the display flex, place the main unit on a book to raise it one-inch (2.54 cm) higher than the display assembly.



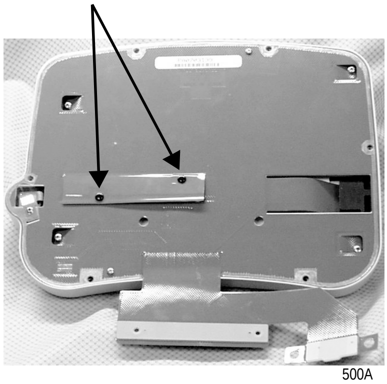
7. Complete the following steps for the monitor you are servicing.

Dash 3000 monitor with display shield flex circuit	Dash 4000 monitor
Separate the monitor bezel from the LCD display. a. Remove the four screws holding the display shield to the LCD display and the two screws holding the display shield to the monitor bezel. ○ four larger screws □ two smaller screws  500A b. Remove the display assembly from the monitor bezel. c. Pull the LCD display isolator out of the way. Disconnect the LCD display cable.  501A d. Disconnect the cable from the backlight inverter PCB.  502A	Separate the front bezel from the transition bezel. a. Remove the six screws from the back of the transition bezel.  506A b. Open the two halves of the display bezel. c. Disconnect the front panel PCB flex cable from the key pad assembly.  511A

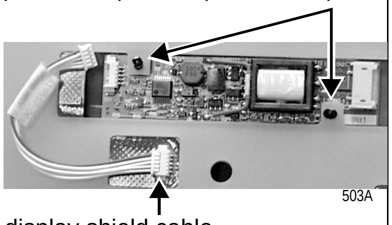
8. Replace or upgrade the display assembly components. Refer to the following sections to service your monitor.
    - "Replacing the Backlight Inverter PCB" on page 8-14.
    - "Replacing the Key Pad Assembly" on page 8-15.
    - "Replacing the Display" on page 8-16.
    - "Replacing or Upgrading the Dash 4000 Alarm Light Option" on page 8-17.
    - "Replacing the Dash 4000 Front Panel PCB" on page 8-18.

Replacing the Backlight Inverter PCB

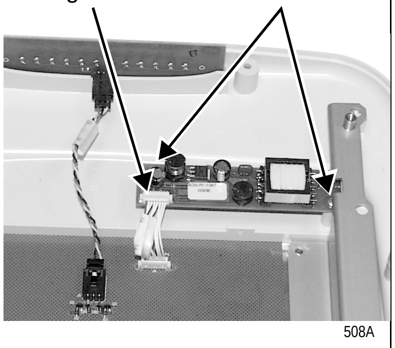
Complete the following steps for the monitor you are servicing.

<table>
<tr><th>Dash 3000 monitor
with display shield flex circuit</th><th>Dash 4000 monitor</th></tr>
<tr><td colspan="2">1. Remove the handle assembly. Refer to 8-7.
2. Remove the display assembly from the main unit. Refer to 8-9.</td></tr>
<tr><td colspan="2">3. Remove and replace the backlight inverter. Follow the steps for the monitor you are servicing.</td></tr>
<tr><td>a. Flip over the display shield flex circuit. Remove the male end of the two snap rivets.


plastic snap rivets (male end)
500A

b. Flip over the display shield flex circuit. Disconnect the display shield cable from the backlight inverter PCB.


plastic snap rivets (female end)
503A
display shield cable

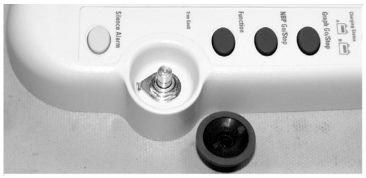
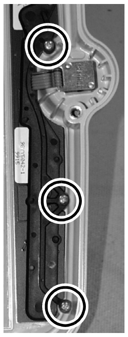
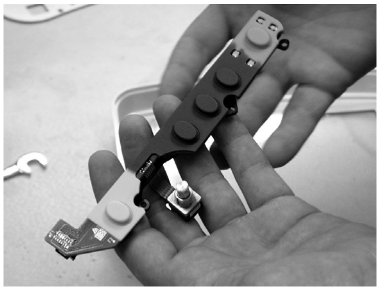
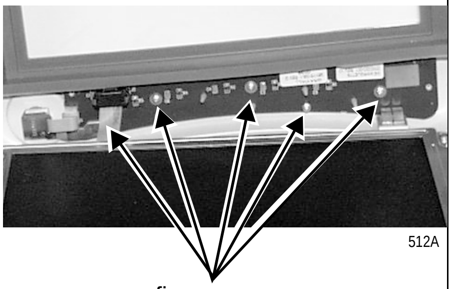
c. Use a screw driver to remove the female end of the two snap rivets. Do not re-use these rivets.
d. Replace the defective backlight inverter PCB.</td><td>a. Remove the LCD color display. Refer to 8-16.
b. Disconnect the backlight cable. Remove the two screws anchoring the backlight inverter PCB to the front panel PCB.


backlight cable
two screws
508A

c. Replace the defective backlight inverter PCB.</td></tr>
<tr><td colspan="2">4. Reassemble the display assembly.</td></tr>
</table>

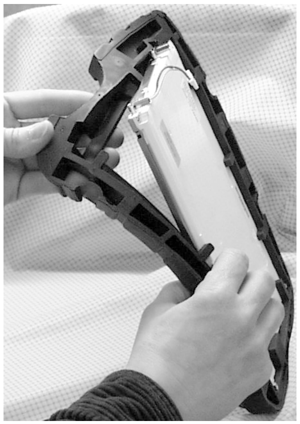
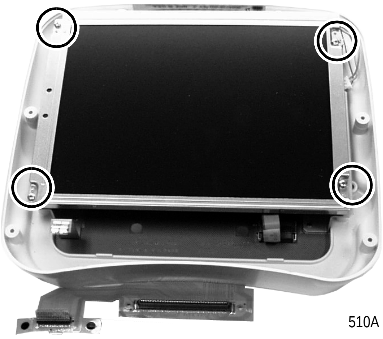
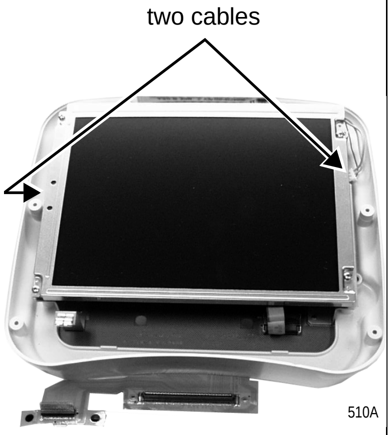
Replacing the Key Pad Assembly

Complete the following steps for the monitor you are servicing.

<table>
<tr><th>Dash 3000 monitor
with display shield flex circuit</th><th>Dash 4000 monitor</th></tr>
<tr><td colspan="2">1. Remove the handle assembly. Refer to 8-7.
2. Remove the display assembly from the main unit. Refer to 8-9.
3. Remove the rubber knob from the Trim Knob control shaft.
4. Use an 11mm wrench or nutdriver to remove the nut holding the Trim Knob control’s shaft to the display bezel.

589A</td></tr>
<tr><td>5. Remove the three screws holding the key pad assembly to the display bezel.

three screws
590A

591A
Keypad Assembly FRU</td><td>5. Remove the five screws holding the key pad assembly to the front bezel.

512A
five screws</td></tr>
<tr><td colspan="2">6. Place the new key pad assembly in the display bezel. Make sure the washer tab fits in the retaining slot of the Trim Knob control’s shaft and replace the 11mm nut.
7. Fasten the new key pad with the screws removed earlier.
8. Reassemble the display assembly.</td></tr>
</table>

Replacing the Display

Complete the following steps for the monitor you are servicing.

<table>
<tr><th>Dash 3000 monitor
with display shield flex circuit</th><th>Dash 4000 monitor</th></tr>
<tr><td colspan="2">1. Remove the handle assembly. Refer to 8-7.
2. Remove the display assembly from the main unit. Refer to 8-9.</td></tr>
<tr><td colspan="2">3. Remove the LCD display. Follow the steps for the monitor you are servicing.</td></tr>
<tr><td>a. Peel back and remove the rubber display isolator from around the display.

504A</td><td>a. Remove the four screws anchoring the display to the display brackets.

510A
b. Disconnect the LCD display PCB cable from the back of the display. Disconnect the backlight inverter PCB cable from the backlight inverter.


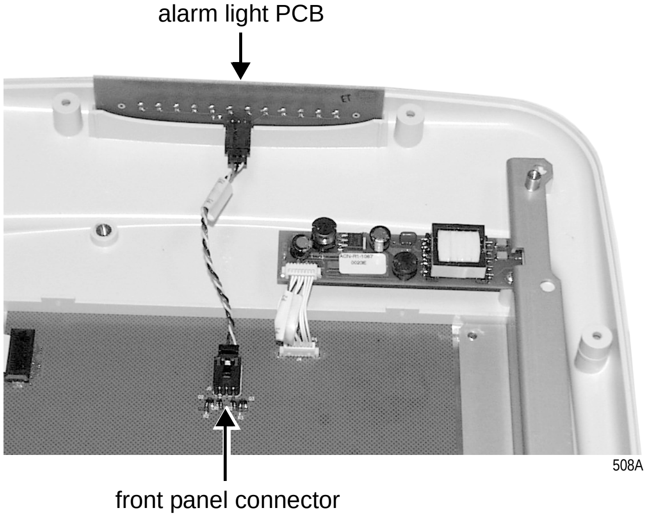
510A</td></tr>
<tr><td colspan="2">4. Replace the defective LCD display and reassemble the display assembly.</td></tr>
</table>

Replacing or Upgrading the Dash 4000 Alarm Light Option

You must disassemble most of the display assembly to replace or upgrade the alarm light option.

1. Remove the handle assembly. Refer to 8-7.
2. Remove the display assembly from the main unit. Refer to 8-9.
3. Remove the LCD color display. Refer to step “3.” on 8-16.
4. Complete the following steps identified for your service procedure.

Alarm Light Replacement	Alarm Light Upgrade (FRU)
a. Remove the clear plastic cover. b. Disconnect the Alarm Light cable from the front panel connector. c. Replace the defective Alarm Light PCB. d. Connect the Alarm Light cable to the front panel connector	a. Remove the blank plastic cover. b. Remove the jumper from the PCB. Refer to “Dash 3000/4000 Assembly PN 2015999, Rev. D” on page 9-29.



5. Replace the clear plastic cover and reassemble the display assembly.

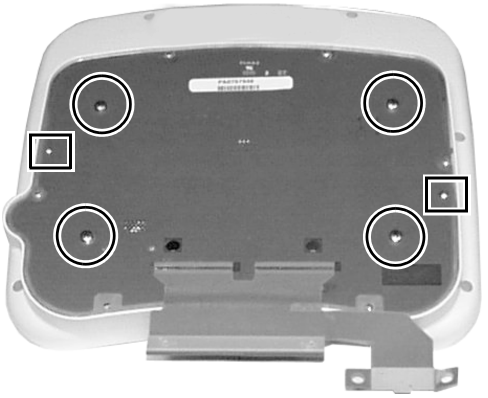
Replacing the Dash 4000 Front Panel PCB

You must disassemble the entire display assembly to replace the front panel PCB.

1. Remove the handle assembly. Refer to 8-7.
2. Remove the display assembly from the main unit. Refer to 8-9.
3. Remove the LCD color display. Refer to step “3.” on 8-16.
4. Remove the backlight inverter PCB. Refer to step “3.” on 8-14.
5. Disconnect the Alarm Light cable from the front panel PCB. Refer to step “4.” on 8-17.
6. Remove the four screws anchoring the front panel PCB to the rear display mounting brackets. Remove the two screws anchoring the front panel PCB to the transition bezel.

○ four larger screws

□ two smaller screws



7. Replace the defective front panel PCB.
8. Reassemble the display assembly.

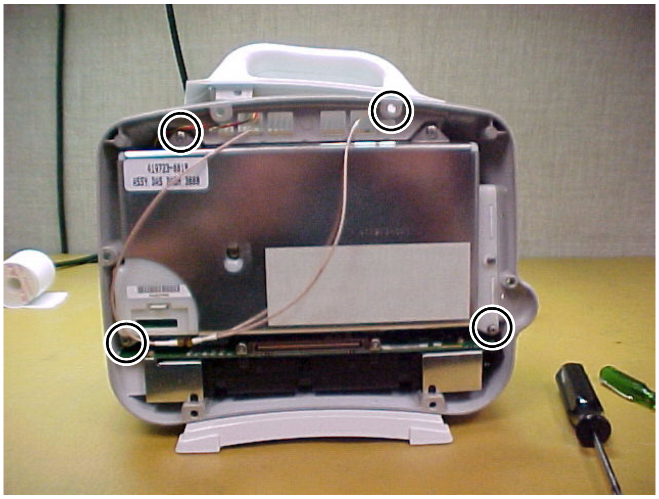
Main Unit Components

DAS and NBP Assemblies

CAUTION
The monitor requires sofware version 5 or later to operate with the Masimo SET SPO2 and 4 BP SuperStat DAS upgrade. If the installation of software version 5 or later is required, GE recommends that you FIRST install the software. Then, install the Masimo SET SPO2 and 4 BP SuperStat hardware upgrade.

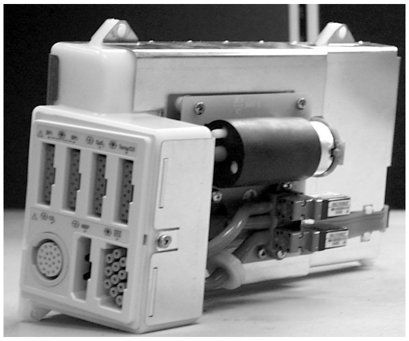
1. Remove the four screws anchoring the Data Acquisition System (DAS) assembly in place.

CAUTION
CAREFULLY remove the DAS assembly so that you do NOT hit the components on the processor/power management PCB.



2. Remove the DAS assembly by first pulling the *left* side out 1/4-inch, then sliding the whole assembly out of the monitor. If the RF LAN

option is installed, use a needle nose pliers to remove the antennae by disconnecting both coax connectors from the PC card.



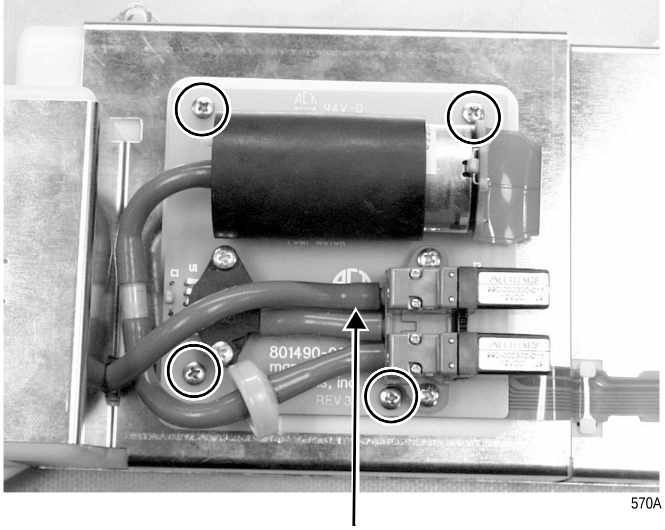
525A

NOTE

> If you need to replace the main assembly, the power supply assembly, and/or the speaker, go to “Main and/or Power Supply Assemblies, Speaker” later in this chapter.

3. Remove the four screws and remove the NBP assembly from the cover of the DAS assembly.
4. Disconnect the tube from the inner solenoid going into the NBP assembly.

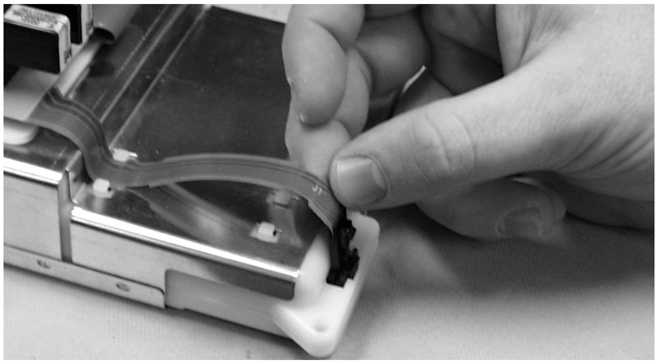
four screws holding the NBP PCB to the DAS assembly



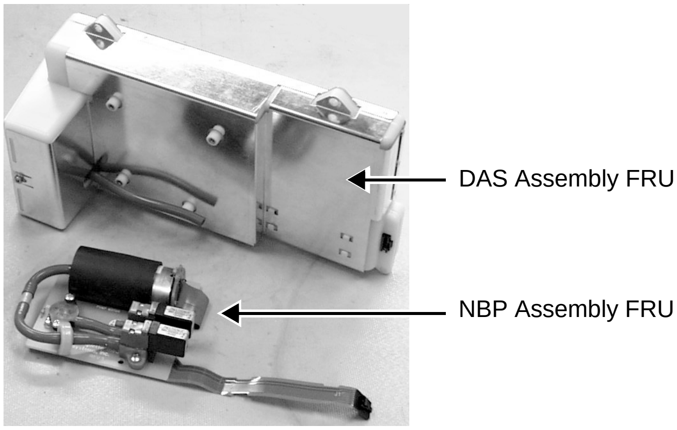
570A

Disconnect this end of the tube.

5. Using a small, flat-blade screwdriver, remove the connector from the NBP assembly to the DAS assembly.



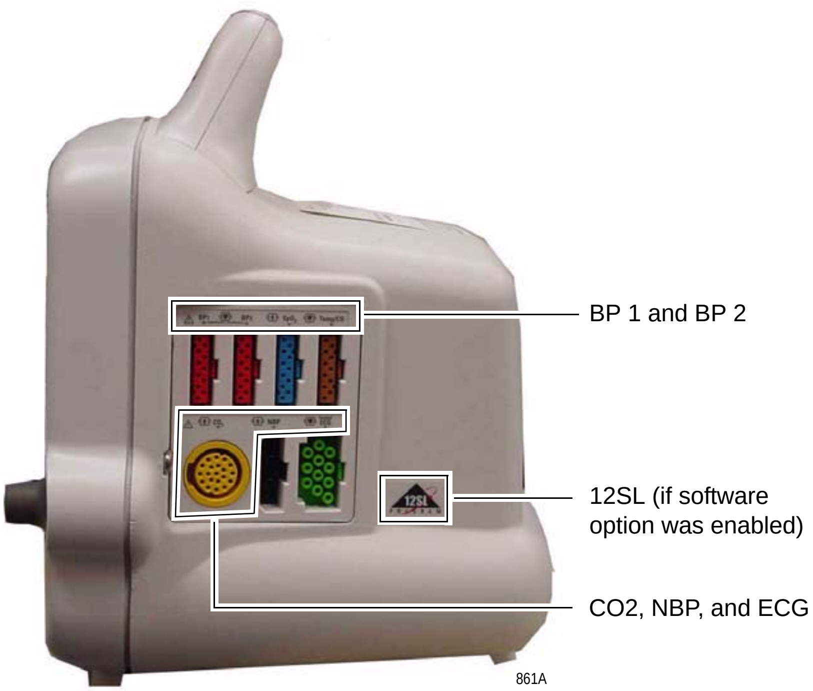
527A



526A

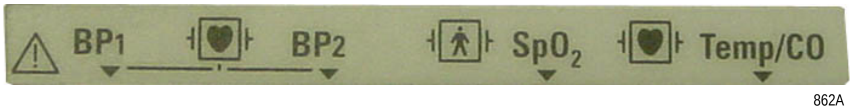
6. If you need to replace the DAS assembly, attach the NBP assembly to the new DAS assembly.
7. If you need to replace the NBP assembly, attach the new NBP assembly to your unit's DAS assembly.
8. Reassemble the DAS and NBP assemblies. Make sure you do not forget:
   - the four mounting screws,
   - the tube connection, and
   - the flex connector.

9. If you installed the GE SPO2 DAS assembly, place the labels as shown below.

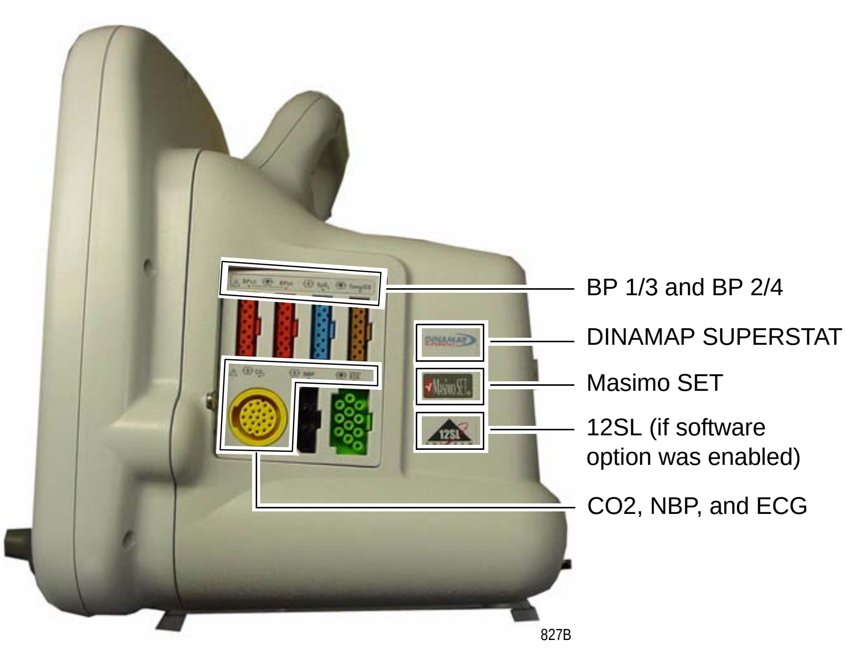

BP 1 and BP 2
12SL (if software option was enabled)
CO2, NBP, and ECG
861A

NOTE

The BP 1 and BP 2 label looks similar to the example below.

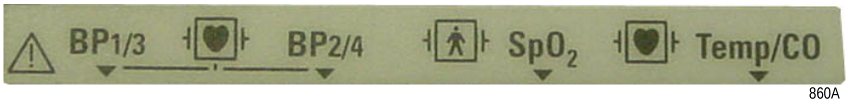

BP1
BP2
SpO2
Temp/CO
862A

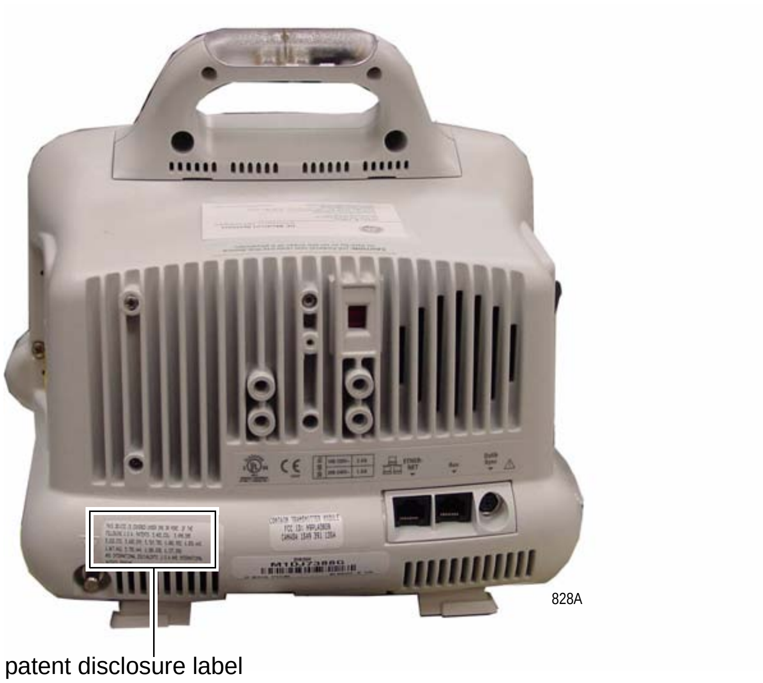
10. If you installed the Masimo SET SPO2 and 4 BP SuperStat upgrade, place the labels as shown below.


BP 1/3 and BP 2/4
DINAMAP SUPERSTAT
Masimo SET
12SL (if software option was enabled)
CO2, NBP, and ECG
827B

NOTE

The BP 1/3 and BP 2/4 label looks similar to the example below.


BP1/3
BP2/4
SpO2
Temp/CO
860A

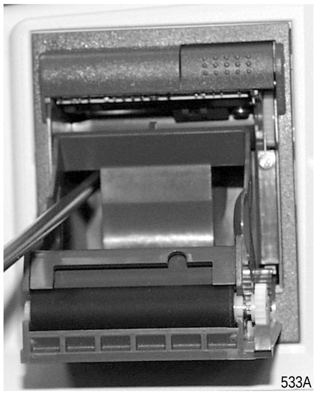

828A
patent disclosure label

11. Reassemble the monitor in reverse order.

Main and/or Power Supply Assemblies, Speaker or RF LAN Upgrade

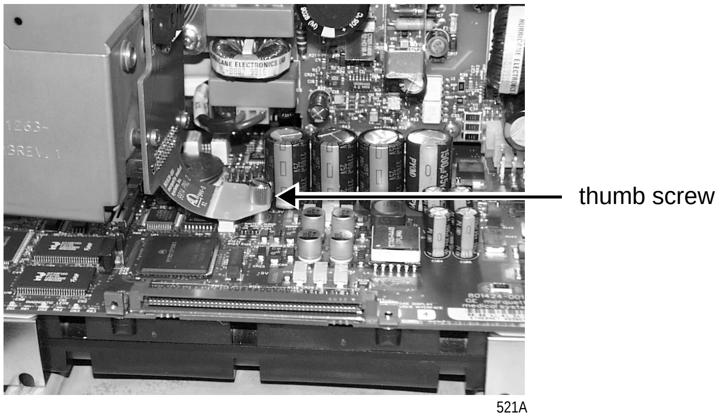
1. If your unit has the writer option, remove the writer by unscrewing the two captive screws inside the writer.

CAUTION
Make sure you approach the screw from *below* the top bar on the paper roll holder so that you do not damage the unit.



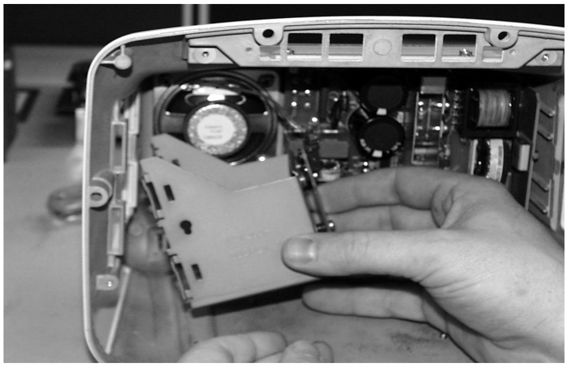
2. Unscrew the thumb screw anchoring the writer cable to the main assembly and disconnect the flex cable from the processor/power management PCB.

NOTE
When securing the thumb screw, first finger-tighten the thumb screw. Then, use a flat-head screw driver to tighten the screw an additional 1/4 turn.



3. Remove the speaker harness and the optional alarm light cable harness from the top of the writer board.
4. Remove the handle of the monitor and set aside.

5. Remove the writer bracket from the frame by squeezing the sides together.



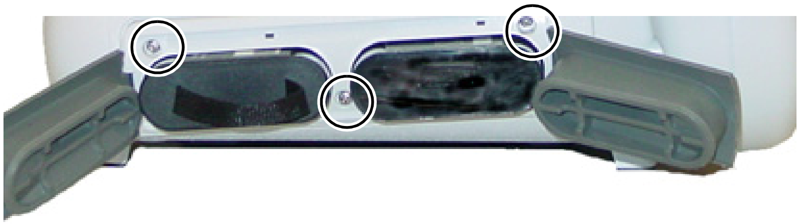
532A

6. If you need to replace the speaker, go to “Speaker.”

Processor/Power Management PCB and Battery Assembly

Follow these steps to replace the processor/power management PCB and battery assembly.

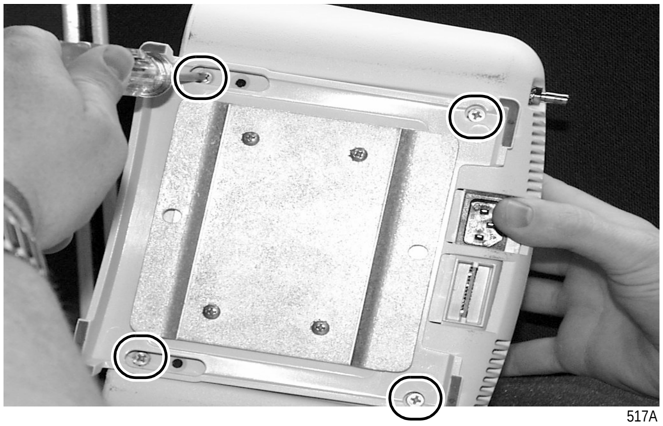
1. Remove the three screws anchoring the battery door assembly to the rear housing. Remove the battery door assembly.



581B

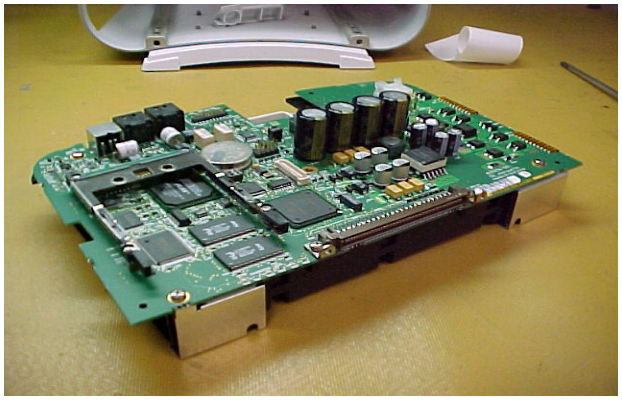
Screws holding battery door.

2. Remove the four panhead screws anchoring the processor/power management assembly to the frame. These screws are attached at the bottom of the unit.

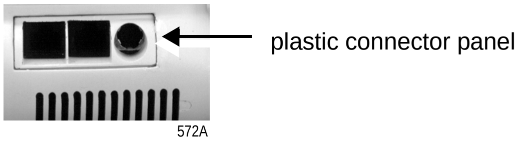


517A

3. CAREFULLY pull the main assembly from the unit.



4. If you need to replace the power supply, go to “Power Supply Assembly.”
5. If you are upgrading with RF LAN, go to “RF LAN Upgrade.”
6. Remove the plastic connector panel from the three connectors at the back of the processor/power management PCB. Install this panel on the new processor/power management PCB before you slide the new assembly into the rear housing.



7. Install the new assembly in the unit.

   NOTE

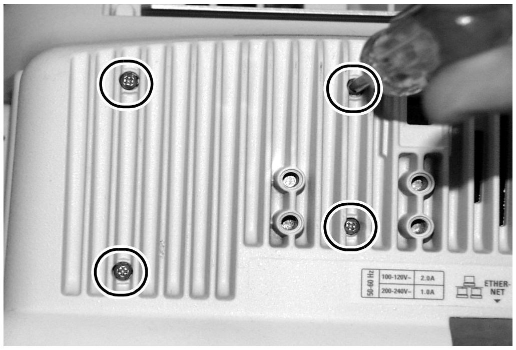
   When securing the thumb screw, first finger-tighten the thumb screw. Then, use a flat-head screw driver to tighten the screw an additional 1/4 turn.

8. Reassemble in reverse order.

Power Supply Assembly

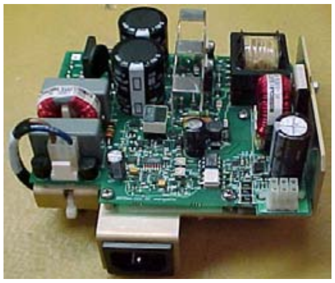
To replace the power supply assembly, follow these steps.

1. While holding the power supply assembly with one hand, remove the four screws from the back of the unit.



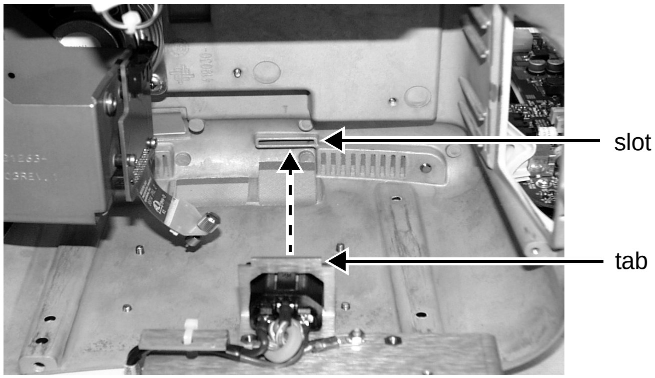
575A

2. Remove the assembly from the unit.



569A

3. Align the tab on the power supply mounting bracket with the slot in the rear housing and install the new assembly in the unit. Fasten the assembly to the rear housing with the screws you removed earlier.



576A

NOTE

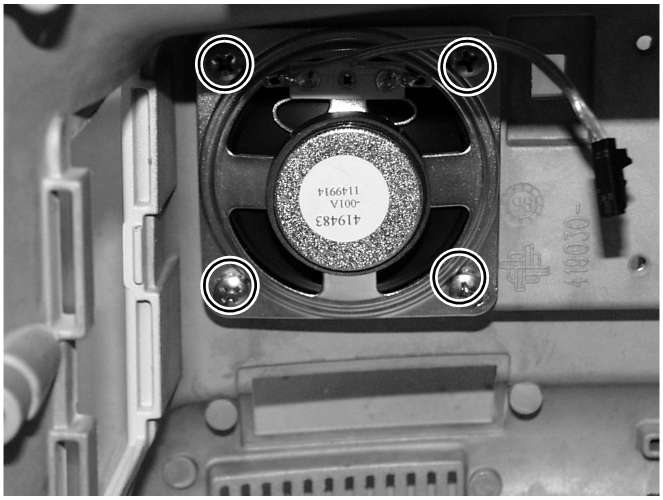
When securing the thumb screw, first finger-tighten the thumb screw. Then, use a flat-head screw driver to tighten the screw an additional 1/4 turn.

4. Reassemble in reverse order.

Speaker

To replace the speaker, follow these steps.

1. Remove the four screws anchoring the speaker to the frame. Remove the speaker from the unit.



586A

2. Install the new speaker in the unit with the cable harness positioned at the top (as shown above). Fasten the speaker with the four screws.

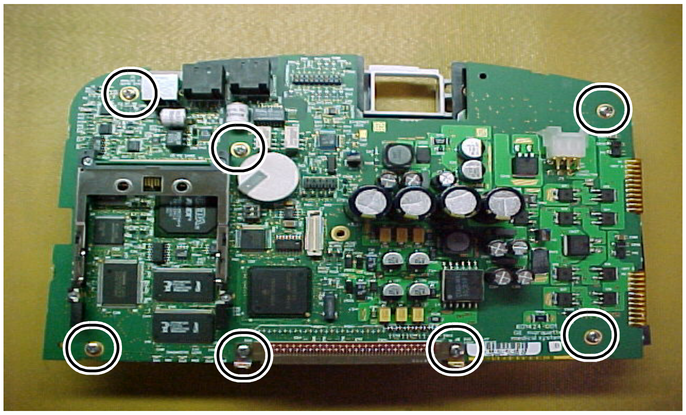
   NOTE

   When securing the thumb screw, first finger-tighten the thumb screw. Then, use a flat-head screw driver to tighten the screw an additional 1/4 turn.

3. Reassemble in reverse order.

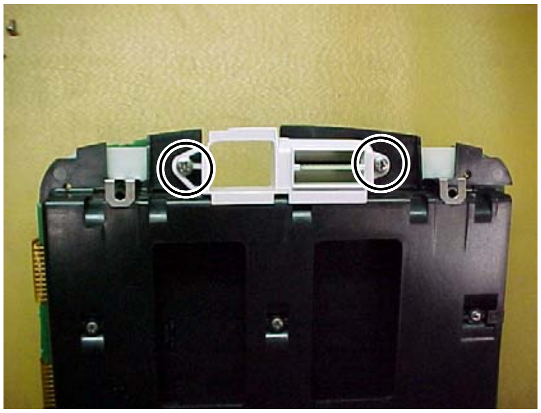
RF LAN Upgrade

1. Remove seven (M3 x 6L) screws from the processor/power management PCB.



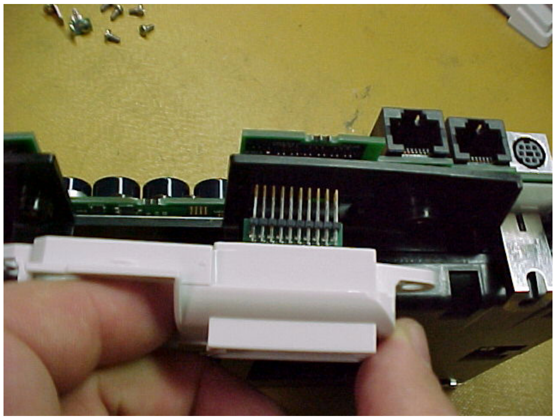
548A

2. Remove the two (M4 x 10L) screws holding on the expansion connector housing.



549A

3. Pull out the expansion connector housing.

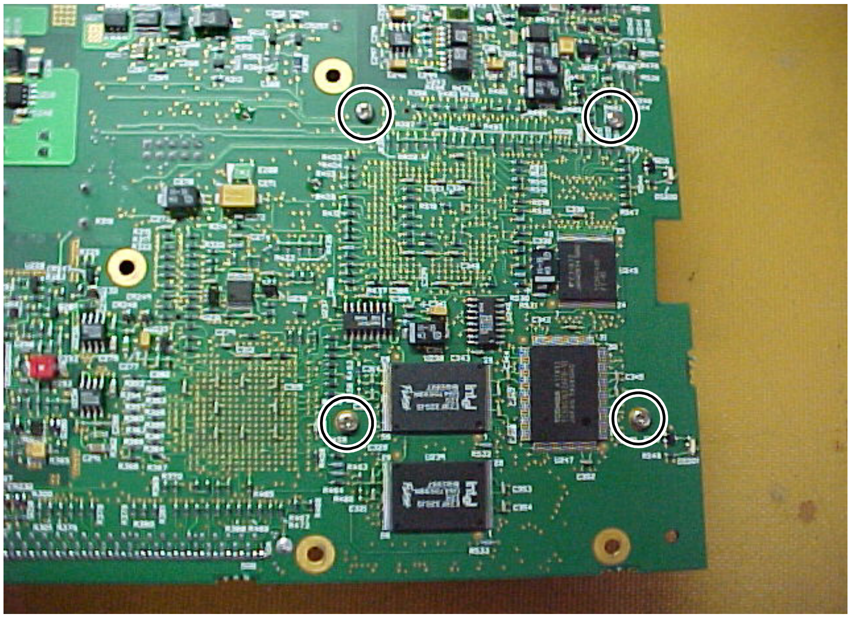


550A

4. Flip over the processor/power management PCB to expose the backside of the PCB.

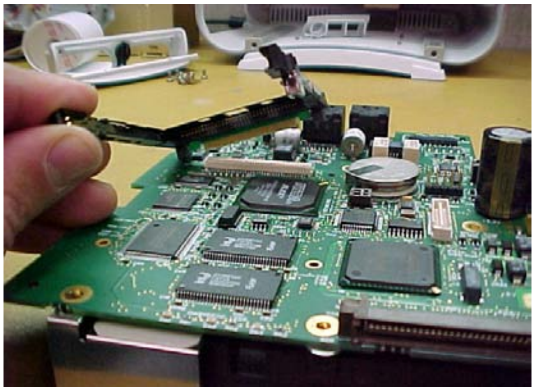
551A

5. Remove the four (M2 x 12L) screws that hold on the PC card socket to the Processor/Power Management PCB. Be careful not to drop the four (M2) nuts captured in the PC card socket when removing these screws. Pull the screws out of the PCB and set aside.



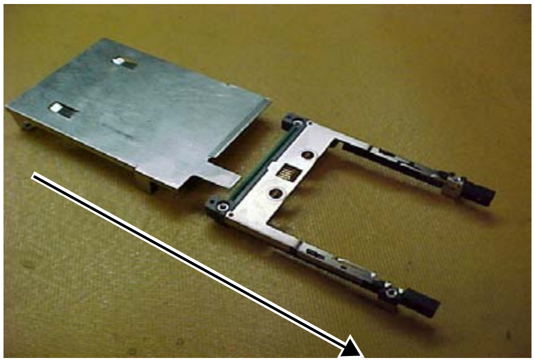
552A

6. Flip over the PCB and remove the PC Card socket from the edge connector.



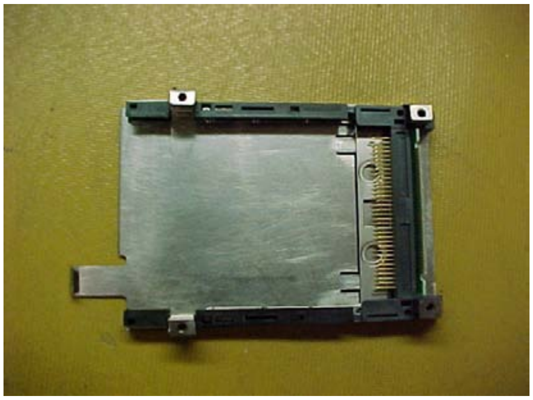
553A

7. With the PC Card socket removed, place the HEX (M2) nuts back into the PC Card socket (if they fell out earlier). Slide the RF LAN shield around the PC Card socket. Use care not to bump the nuts out of their position.



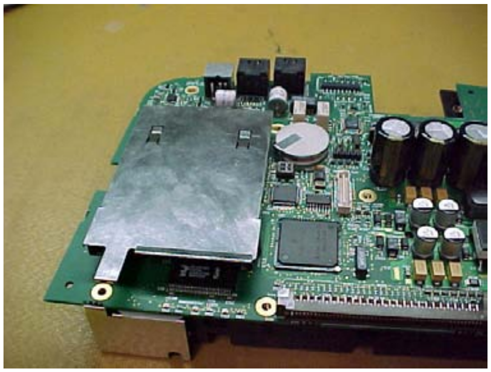
554A

8. Be sure to have the RF shield in place so the holes line up on the underside. The HEX nuts are captured in the PC Card socket and are held into place by the shield.



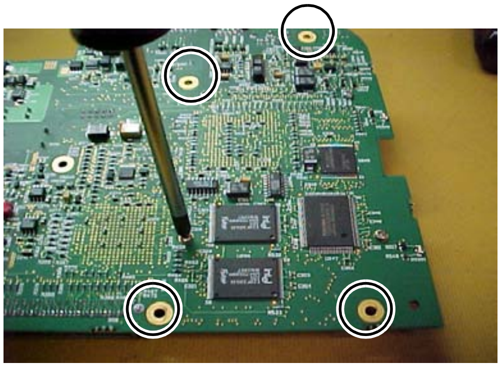
555A

9. Install the PC Card socket with the attached RF LAN shield into the card edge connector on the PCB.



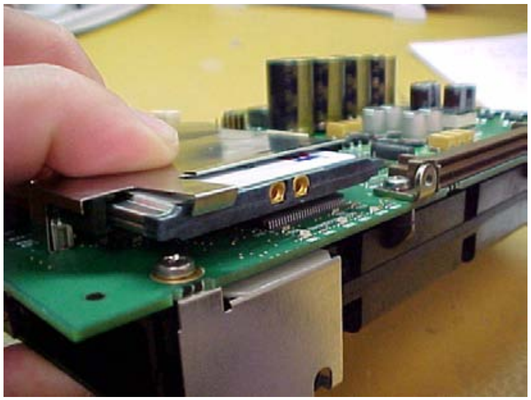
556A

10. Flip over the PCB again. With the PC card socket in place, install the four screws and tighten.



557A

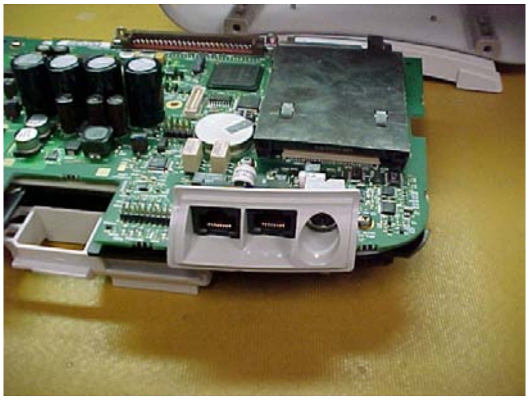
11. Install the seven screws from Step 1. Do NOT place a screw next to J7.
12. Apply the supplied regulatory label below the Symbol PC card's existing label. Refer to the RF LAN kit for the label.
13. Install Symbol PC card. Clip to hold card in place.



558A

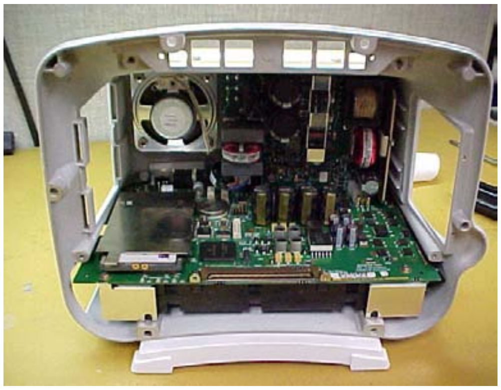
14. Install the expansion connector housing as done in Steps 2 and 3.

15. Install the panel connector back onto the back of the processor/power management PCB before you slide the assembly back into the monitor's housing.



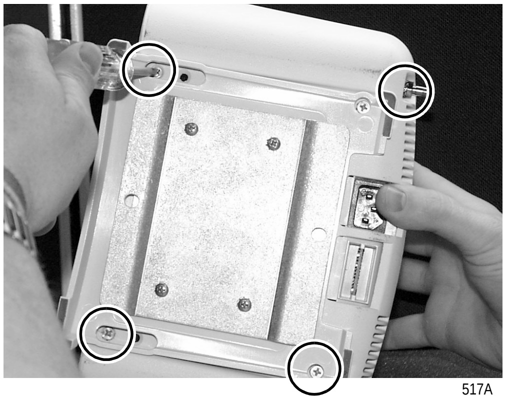
559A

16. Slide the Processor/Power Management assembly back into the monitor's housing.



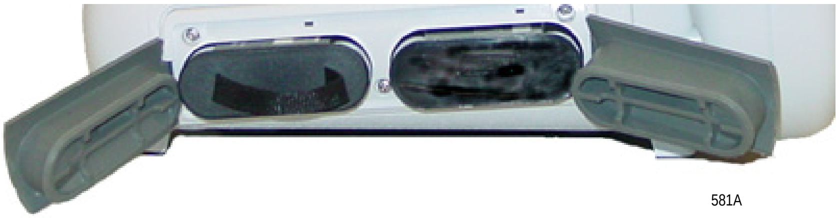
560A

17. Install the four panhead screws.



517A

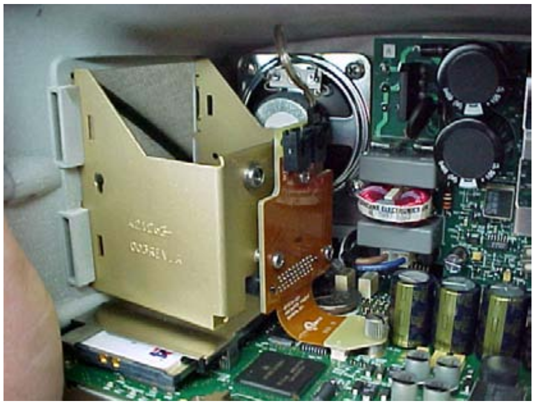
18. Re-install the battery door Assembly.



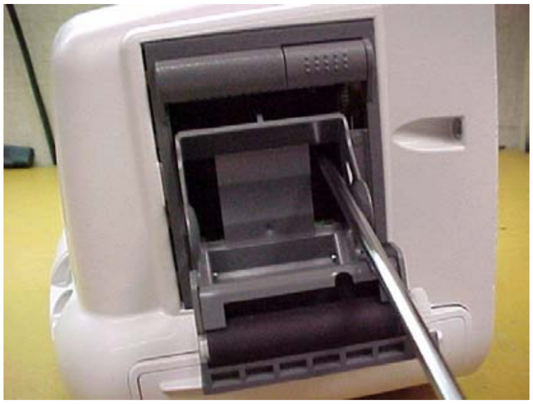
19. Install writer bracket in place. Connect the speaker cable to the writer flex circuit. Connect the writer flex to J7 on the Processor/ Power Management PCB and secure it with the thumbscrew.

NOTE

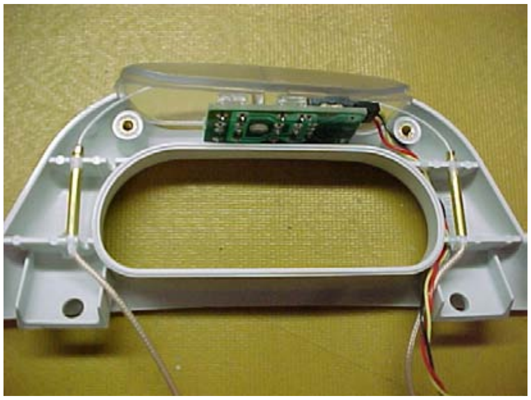
When securing the thumb screw, first finger-tighten the thumb screw. Then, use a flat-head screw driver to tighten the screw an additional 1/4 turn.



20. Install writer (if equipped) or blank plate. (Writer option shown here.)

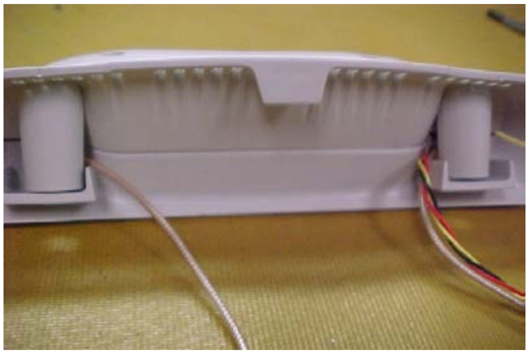


21. Disassemble the handle assembly by removing top two screws.
22. Install the RF LAN antennas as shown into the plastic groves. The antenna could be held in place with adhesive or sticky tape to help aid in reassembly of the handle.



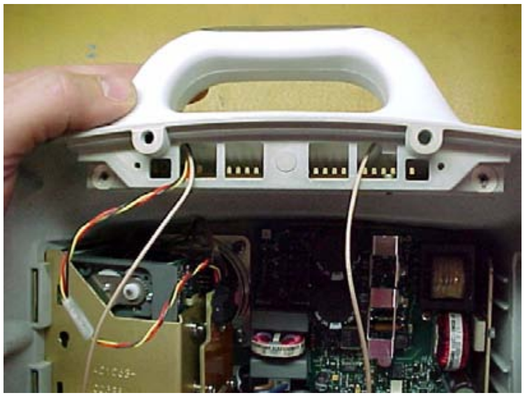
564A

23. Reassemble the handle with the top two screws. Route cables out the bottom of the handle as shown as to not pinch antennas between the handle halves.



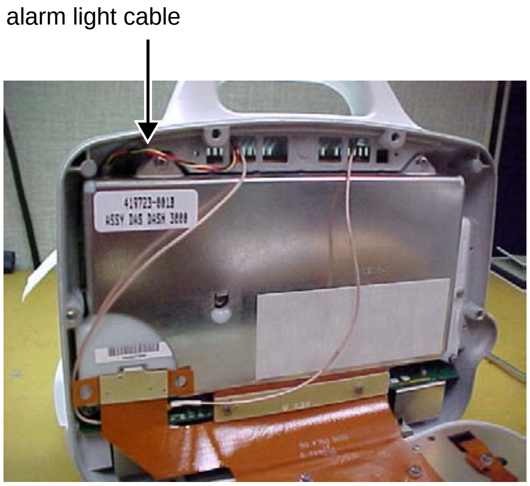
565A

24. Route cables into the monitor’s housing as shown. Connect the alarm cable to the writer bracket.



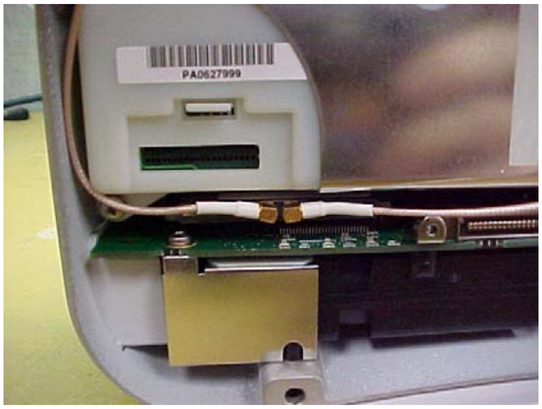
566A

25. Reinstall DAS assembly. When installing the DAS assembly, it is critical not to pinch the coax's or alarm light cable. Route alarm light cable behind the DAS and off to the side of the upper left mounting screws as shown in the picture below. Use four screws (M3 x 12L with washers) to mount the DAS.



568A

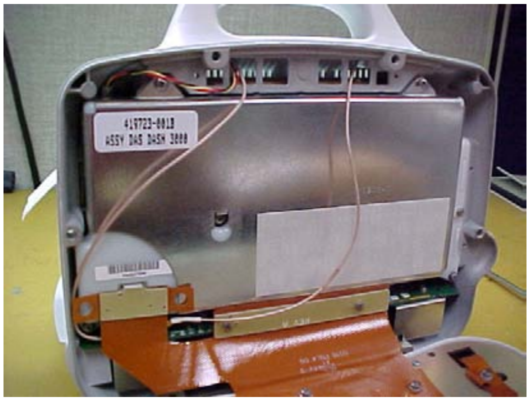
26. Use needle nose pliers to snap the two coax connectors into the Symbol PC card. Route coaxes per the picture. Note that the left coax is routed above the RF LAN shield retaining clip.



567A

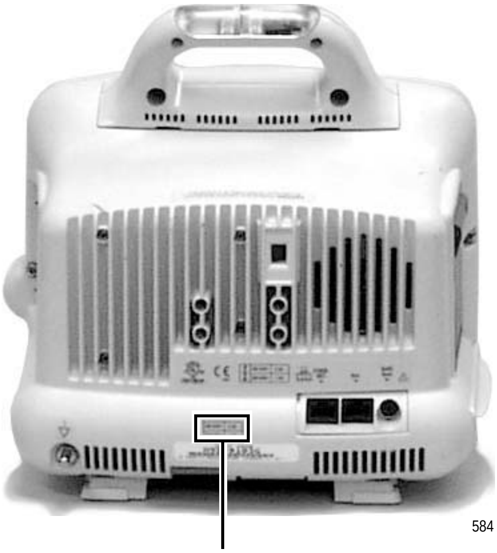
27. Reinstall Display assembly. Use two (M3 x6L) screws to mount the flex to the Processor/Power management PCB.

28. Reconnect the display flex to the DAS assembly. During assembly, verify the RF LAN coaxes are not pinched between the front bezel assembly and the rear housing.



29. Reattach the display assembly to the monitor's rear housing. It is helpful to lay the monitor face down on a non-abrasive, static-free surface. Make sure the **Trim Knob** control hangs over the edge of the surface to prevent damage.
    - Top screws are M4 x 28L
    - Side screws are M4 x 14L
    - Bottom screws are M4 x 25L

30. Adhere RF LAN label to the rear of the monitor as shown.



Place RF LAN label here.

31. Reinstall the batteries and plug into AC power and verify that Wireless LAN is enabled.

Verify Wireless LAN is Enabled

Confirm the configuration of the optional Wireless LAN.

1. Activate the Boot Code:
   a. Hold down **NBP GO/STOP** and **ZERO ALL**.
   b. Press and release the **Trim Knob** control.
   c. Keep holding **NBP GO/STOPNBP GO/STOP** and **ZERO ALL** until the Boot Code information appears on the display.
2. Select *SERVICE MENU > SET CONFIGURATION*.
3. In the Configuration Menu, select *Configure Wireless LAN*.
4. Select *Set SSID to factory default*.
5. Verify Wireless LAN is set to *Enable*.
6. *Select Exit > Exit*. Reboot the monitor (press and release **NBP GO/STOP**, **ZERO ALL** and the **Trim Knob** control.

Verify the Wireless LAN ID Number

1. Select *MORE MENU > MONITOR SETUP > REVISION AND ID*.
2. Select *Next > Next*.
3. Verify that WIRELESS LAN ID is showing US 01 V4.65 xxxxxx. If no ID is displayed, complete the following tasks.
   a. Recheck the setup in the Boat Loader menu.
   b. Check if the Symbol PC card is installed correctly

Verify Wireless LAN Communications

1. Connect a Symbol Access Point with AC power and a Unity MC Network node. Refer to the Wireless LAN (Symbol Access Point) Installation and Service Manual. Power up the access point
2. Disconnect the Ethernet line from the back of the monitor then connect a patient simulator to display ECG waveforms on the monitor’s display. Verify the unit name matches the unit name at the central station. Admit the patient at the monitor.
3. Verify waveforms are displayed at the central station for the monitor.
4. Connect the Ethernet jack to the back of the monitor. Verify that no more than three seconds of drop out occurs at the central station during the network switch over.
5. With the monitor now operating on the Ethernet connection, disconnect the Ethernet jack from the back of the monitor and verify that no more than three seconds of drop out occurs at the central station during the network switch over.
6. Place the simulator into a Crisis alarm and verify the audio on the speaker is functional and that the Alarm Light (if installed) is flashing RED when in alarm.
7. Discharge test patient and remove all cables. *End of test.*

Optional DDW Writer Replacement/Upgrade

Replacement

There are two compatible writers. The instructions for assembly/ disassembly are the same for each writer.

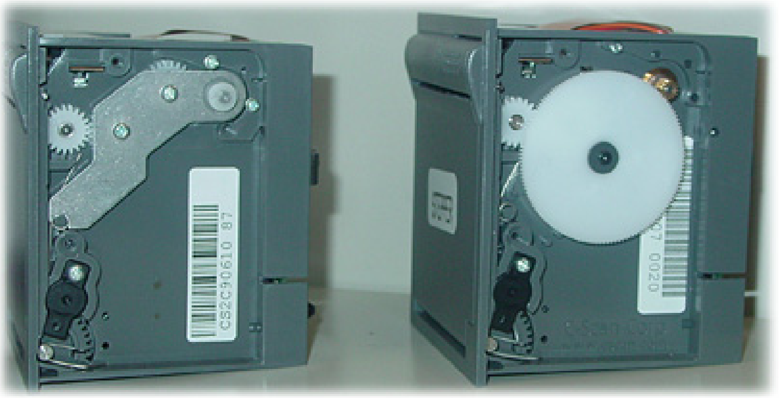
NOTE

You do not need to disassemble the monitor to replace or upgrade the optional printer.

1. Remove the writer by unscrewing the two captive screws inside the writer.

CAUTION

Make sure you approach the screw from *below* the top bar on the paper roll holder so that you do not damage the unit.



546A

2-Inch Writer Assembly FRU

2. Remove the writer from the unit.
3. Insert the new writer into the rear housing to engage with the blind mate connector.
4. Secure the writer with the two captive screws inside the writer.
5. Perform the Graph Test in chapter four, Maintenance.

Upgrade

If upgrading the monitor to add a writer, pry off the blank cover with a flat blade screw driver. The cover may crack or break when removing. Once the cover is removed it can be discarded. Proceed with steps 3 and 4 above.

9 Assembly Drawings

NOTE

The assembly drawings in this manual only support monitors with the **AAB** product code. For assembly drawings for monitors with a **DJ** or **EH** product code, please refer to the service manual that was provided with the monitor.

NOTE

An assembly BOM may list packaging items that are used to protect the unit during shipment. However, these packaging items may NOT be shown on the assembly drawings.

For your notes

Introduction

Included in this section is the Theory of Operation along with upper level assembly drawings. These drawings provide reference for major components of the monitor in the form of mechanical and electrical diagrams.

The assembly drawings for all of the monitors configurations are broken down as follows:

Electrical diagrams — These diagrams provide a reference to electrical assemblies in the monitors.

Exploded views — These diagrams provide reference to the individual parts used in the monitors.

Parts Lists — These lists provide part number and descriptive cross-reference to all parts and subassemblies found in each of the drawings.

Port Connections — These photos and tables provide signal information for the various connectors on the monitors.

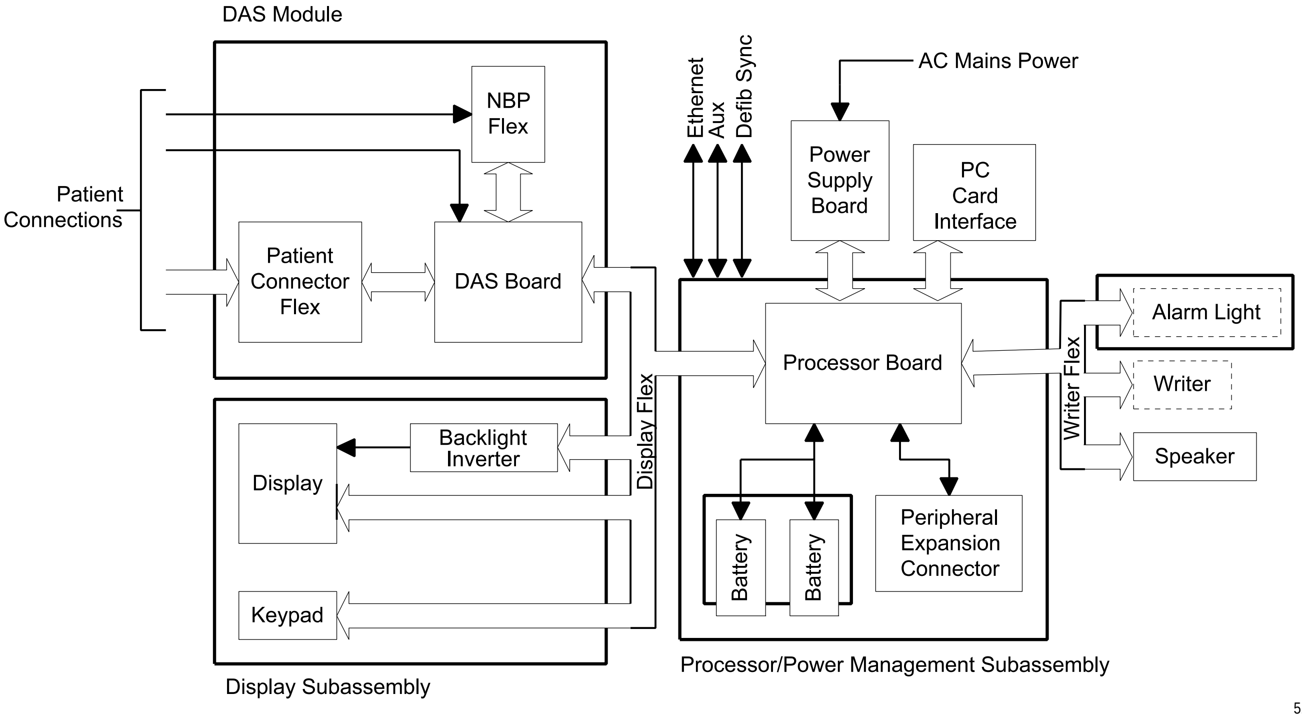
Theory Of Operation

Components

The monitor is housed in a single package. The main components of the assembly are:

- Power Supply,
- Data Acquisition System,
- Processor/Power Management subsystem (including battery case and expansion connector),
- Speaker,
- Handle subassembly (including the Alarm Light option), and
- Thermal Printer (optional).

Overall Monitor Block Diagram


DAS Module
Patient Connections
NBP Flex
Patient Connector Flex
DAS Board
Ethernet
Aux
Defib Sync
AC Mains Power
Power Supply Board
PC Card Interface
Alarm Light
Processor Board
Writer Flex
Writer
Speaker
Display Flex
Backlight Inverter
Display
Keypad
Battery
Battery
Peripheral Expansion Connector
Display Subassembly
Processor/Power Management Subassembly
516A

Power Supply

The subsystems within the monitor operate from a common 9 to 18 V power bus. Due to the wide variety of voltages required by the various subsystems, power is converted locally by each subsystem. This architecture results in an efficient and compact system by reducing the number of conversions required and optimizing the physical size of each converter for the specific application.

When operating on AC mains power, the power bus voltage is 18 V, generated by the offline switching power supply.

No AC mains power switch is provided.

The line voltage range switch must be set to select 115 V or 230 V (90 to 132 VAC or 190 to 264 VAC, respectively).

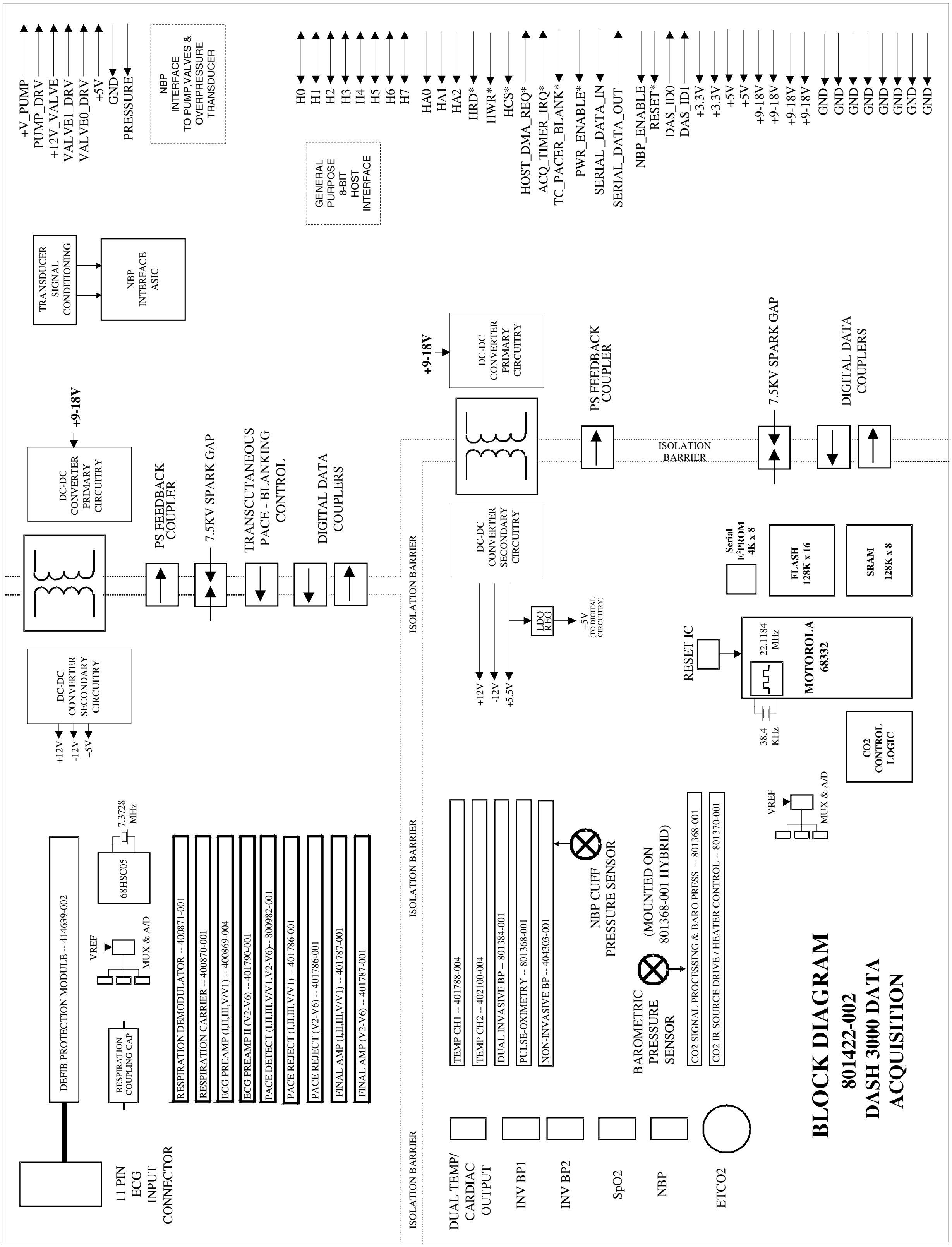
Data Acquisition System (DAS)

All interfaces to the patient occur through the DAS. The ECG function uses a direct connection to the patient; therefore it is separately isolated from the other functions (except respiration, which shares the ECG patient interface) to substantially reduce coupling of noise and leakage currents to/from other functions. All remaining DAS functions (i.e., pulse oximetry, NBP, invasive pressure, temperature, cardiac output, and CO_2) share a common isolation barrier.

NOTE

> The monitor supports two SPO2 configurations, GE SPO2 and Masimo SET SPO2.

DAS Block Diagram with GE SPO2


+V_PUMP
PUMP_DRV
+12V_VALVE
VALVE1_DRV
VALVE0_DRV
+5V
GND
PRESSURE
NBP INTERFACE TO PUMP,VALVES & OVERPRESSURE TRANSDUCER
H0
H1
H2
H3
H4
H5
H6
H7
GENERAL PURPOSE 8-BIT HOST INTERFACE
HA0
HA1
HA2
HRD*
HWR*
HCS*
HOST_DMA_REQ*
ACQ_TIMER_IRQ*
TC_PACER_BLANK*
PWR_ENABLE*
SERIAL_DATA_IN
SERIAL_DATA_OUT
NBP_ENABLE
RESET*
DAS_ID0
DAS_ID1
+3.3V
+3.3V
+5V
+5V
+9-18V
+9-18V
+9-18V
+9-18V
GND
GND
GND
GND
GND
GND
GND
GND
TRANSDUCER SIGNAL CONDITIONING
NBP INTERFACE ASIC
+9-18V
DC-DC CONVERTER PRIMARY CIRCUITRY
PS FEEDBACK COUPLER
7.5KV SPARK GAP
TRANSCUTANEOUS PACE - BLANKING CONTROL
DIGITAL DATA COUPLERS
DC-DC CONVERTER SECONDARY CIRCUITRY
+12V
-12V
+5V
+9-18V
DC-DC CONVERTER PRIMARY CIRCUITRY
PS FEEDBACK COUPLER
7.5KV SPARK GAP
DIGITAL DATA COUPLERS
ISOLATION BARRIER
DC-DC CONVERTER SECONDARY CIRCUITRY
LDO REG
+5V (TO DIGITAL CIRCUITRY)
+12V
-12V
+5.5V
Serial E²PROM 4K x 8
FLASH 128K x 16
SRAM 128K x 8
RESET IC
22.1184 MHz
MOTOROLA 68332
38.4 KHz
CO2 CONTROL LOGIC
VREF
MUX & A/D
ISOLATION BARRIER
ISOLATION BARRIER
ISOLATION BARRIER
ISOLATION BARRIER
DEFIB PROTECTION MODULE -- 414639-002
68HSC05
7.3728 MHz
VREF
MUX & A/D
RESPIRATION COUPLING CAP
RESPIRATION DEMODULATOR -- 400871-001
RESPIRATION CARRIER -- 400870-001
ECG PREAMP (I,II,III,V/V1) -- 400869-004
ECG PREAMP II (V2-V6) -- 401790-001
PACE DETECT (I,II,III,V/V1,V2-V6) -- 800982-001
PACE REJECT (I,II,III,V/V1) -- 401786-001
PACE REJECT (V2-V6) -- 401786-001
FINAL AMP (I,II,III,V/V1) -- 401787-001
FINAL AMP (V2-V6) -- 401787-001
TEMP CH1 -- 401788-004
TEMP CH2 -- 402100-004
DUAL INVASIVE BP -- 801384-001
PULSE-OXIMETRY -- 801368-001
NON-INVASIVE BP -- 404303-001
NBP CUFF PRESSURE SENSOR
(MOUNTED ON 801368-001 HYBRID)
BAROMETRIC PRESSURE SENSOR
CO2 SIGNAL PROCESSING & BARO PRESS -- 801368-001
CO2 IR SOURCE DRIVE / HEATER CONTROL -- 801370-001
BLOCK DIAGRAM
801422-002
DASH 3000 DATA ACQUISITION
11 PIN ECG INPUT CONNECTOR
DUAL TEMP/ CARDIAC OUTPUT
INV BP1
INV BP2
SpO2
NBP
ETCO2

The DAS block diagram with GE SPO2 consists of the following three sections.

Section	Description
ECG/Respiration	Separately isolated section includes a 7.3728MHz 68HSC05 microcontroller, A/D conversion, signal processing hybrids and DC-DC isolation converter.
Main DAS	Separately isolated section includes a 22.1184MHz 68332 microcontroller with FLASH and SRAM memory, A/D conversion, signal processing hybrids and DC isolation converter.
Non-Isolated circuits	Includes serial and parallel host interfaces and NBP pump, valves, and over-pressure circuitry.

ECG

The ECG function detects heartbeats and arrhythmias, measures heart rate (HR) and ST segment deviation, and generates a 12SL diagnostic interpretation. Patient alarms with adjustable high and low limits for HR and ST segment deviation are provided. Additional patient alarms are provided for arrhythmias and PVCs. System alarms for individual lead failure and all leads failure are provided.

The monitor accepts the green 3, 5, and 10-leadwire Multi-link ECG connectors (compatible with Eagle 3000 monitor, Eagle 4000 monitor, and Tram modules).

Respiration

The respiration function measures respiration rate (RR) and detects apnea through the ECG leadwires using the impedance variation technique. Patient alarms for RR (with adjustable high and low limits) and apnea (with adjustable time limit) are provided. System alarms for lead failure, cardiac artifact, and learning are provided.

GE Pulse Oximetry (SpO_2)

The pulse oximetry function measures arterial oxygen saturation (SpO_2) and peripheral pulse rate (PPR). Patient alarms with adjustable high and low limits for SpO_2 and PPR are provided. System alarms for probe off patient, low-quality signal, and pulse search are provided.

The monitor accepts the blue color-coded pulse oximetry connector (compatible with Eagle 3000 monitor, Eagle 4000 monitor, and the Tram *x*50-series modules). The monitor with GE SPO2 supports GE and Nellcor probes.

Non-Invasive Blood Pressure

The NBP function measures systolic pressure, diastolic pressure, mean pressure, and heart rate. Patient alarms with adjustable high and low limits for systolic, diastolic, and mean pressures are provided. System alarms for deflation failure, inflation failure, maximum pressure exceeded, measurement time exceeded, pulse too weak, hardware malfunction, and system pressure leak are provided.

The NBP function operates in manual, auto, and stat measurement modes. The monitor has backup protections for magnitude and duration of applied cuff pressure (with different settings in adult and neonatal modes).

The monitor accepts the rectangular NBP connector (compatible with the Eagle 3000 monitor and some versions of the Tram module).Invasive Pressure

The invasive pressure function measures two blood pressures and calculates systolic pressure, diastolic pressure, mean pressure, and pulsatile pressure rate where applicable. Patient alarms with adjustable high and low limits for systolic pressure, diastolic pressure, mean pressure, and pulse rate are provided for each channel. System alarms for sensor status (failure and disconnected), Smart BP event (artifact), zeroing status (not zeroed, failure, and pressure sensed), and PA Wedge status (wait, inflate, processing, complete, and no pulse) are provided.

The user can set an adjustable low-pass filter to 12 or 40 Hz. The 12 Hz filter is implemented in software; the filter is disabled at the 40 Hz setting.

The monitor accepts the red color-coded invasive pressure connectors (compatible with the Eagle 3000 monitor, Eagle 4000 monitor, and Tram modules).

Temperature

The temperature function measures two temperatures. Patient alarms with adjustable high and low limits for temperature are provided. System alarms for sensor and calibration failures are provided.

The monitor accepts the brown color-coded connector (compatible with the Eagle 3000 monitor, Eagle 4000 monitor, and Tram modules). The monitor supports both YSI Series 400 and 700 thermistor probes. The probe type is determined by identification signals in the probe adapter cable.

The temperature connector and measurement circuits are shared with the cardiac output monitoring function; therefore you cannot use both functions concurrently. A signal in the patient cable indicates the appropriate function.

Cardiac Output

The cardiac output function measures blood temperature and injectate temperature, and uses the thermal dilution method to calculate cardiac output. Patient alarms with adjustable high and low limits for blood temperature are provided. System alarms for sensor failure and unstable blood temperature are provided.

The monitor accepts the brown color-coded connector (compatible with the Eagle 4000 monitor and Tram modules).

The cardiac output connector and measurement circuits are shared with the temperature monitoring function. You cannot use both functions concurrently. A signal in the patient cable indicates the appropriate function.

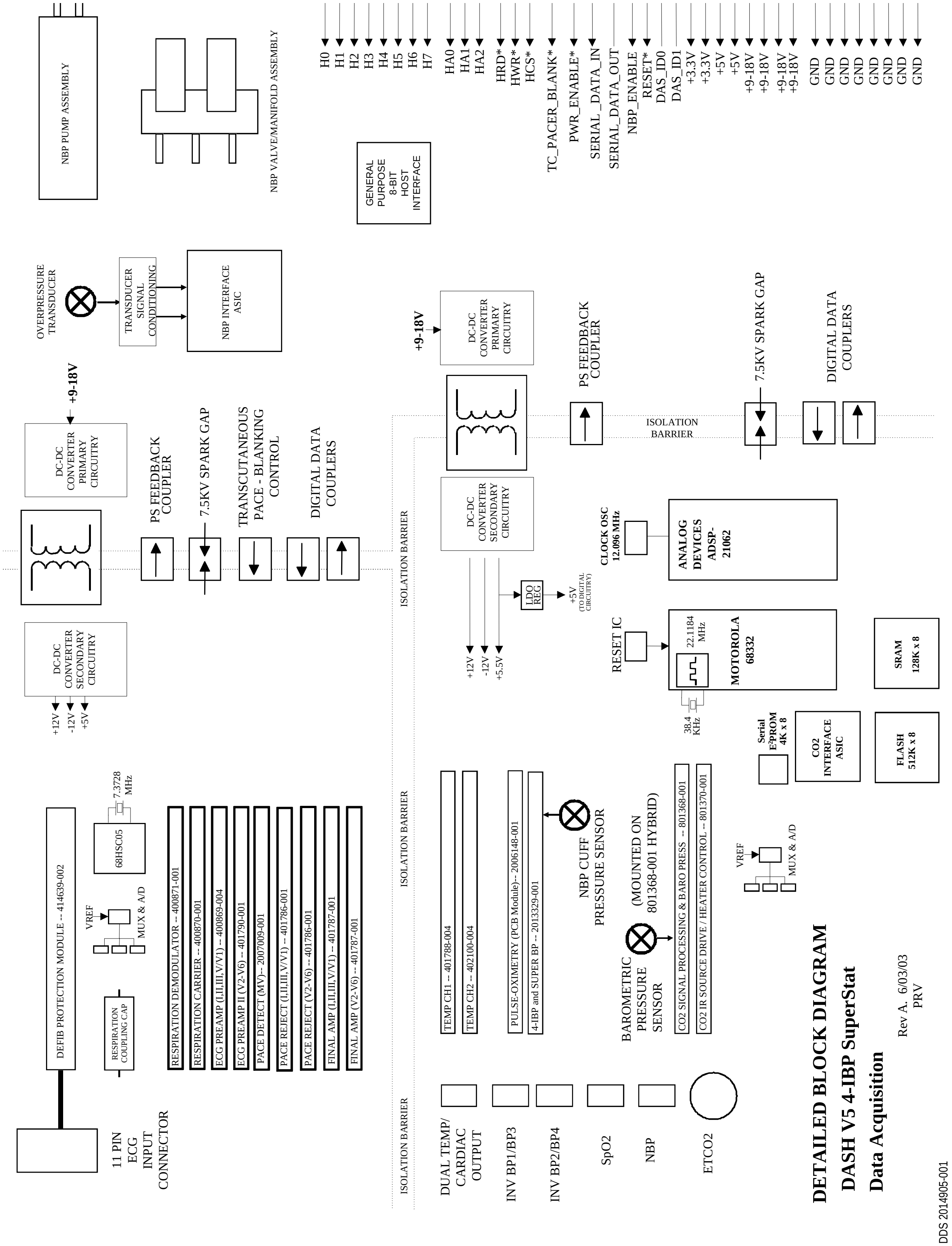
Carbon Dioxide (CO_2)

The CO_2 function measures inspired and expired CO_2 and respiration rate using the infrared light absorption technique. The monitor connects to an external Novametrix Capnostat III sensor that clips to an airway adapter in the patient's ventilation circuit. The circuits to drive the sensor and process its incoming signal are located within the DAS.

Patient alarms with adjustable high and low limits for inspired CO_2, expired CO_2, and respiration rate are provided. An additional patient alarm for no breath detected is provided. System alarms for various sensor conditions are provided.

The monitor accepts the yellow color-coded connector.

DAS Block Diagram with Masimo SET SPO2 and 4 BP SuperStat Channels


NBP PUMP ASSEMBLY
NBP VALVE/MANIFOLD ASSEMBLY
GENERAL PURPOSE 8-BIT HOST INTERFACE
H0
H1
H2
H3
H4
H5
H6
H7
HA0
HA1
HA2
HRD*
HWR*
HCS*
TC_PACER_BLANK*
PWR_ENABLE*
SERIAL_DATA_IN
SERIAL_DATA_OUT
NBP_ENABLE
RESET*
DAS_ID0
DAS_ID1
+3.3V
+3.3V
+5V
+5V
+9-18V
+9-18V
+9-18V
+9-18V
GND
GND
GND
GND
GND
GND
GND
GND
OVERPRESSURE TRANSDUCER
TRANSDUCER SIGNAL CONDITIONING
NBP INTERFACE ASIC
+9-18V
DC-DC CONVERTER PRIMARY CIRCUITRY
PS FEEDBACK COUPLER
7.5KV SPARK GAP
DIGITAL DATA COUPLERS
ISOLATION BARRIER
+9-18V
DC-DC CONVERTER PRIMARY CIRCUITRY
PS FEEDBACK COUPLER
7.5KV SPARK GAP
TRANSCUTANEOUS PACE - BLANKING CONTROL
DIGITAL DATA COUPLERS
DC-DC CONVERTER SECONDARY CIRCUITRY
+12V
-12V
+5V
DC-DC CONVERTER SECONDARY CIRCUITRY
LDO REG
+5V (TO DIGITAL CIRCUITRY)
+12V
-12V
+5.5V
CLOCK OSC 12.096 MHz
ANALOG DEVICES ADSP-21062
RESET IC
22.1184 MHz
MOTOROLA 68332
38.4 KHz
SRAM 128K x 8
Serial E²PROM 4K x 8
CO2 INTERFACE ASIC
FLASH 512K x 8
ISOLATION BARRIER
ISOLATION BARRIER
ISOLATION BARRIER
7.3728 MHz
68HSC05
VREF
MUX & A/D
DEFIB PROTECTION MODULE -- 414639-002
RESPIRATION COUPLING CAP
RESPIRATION DEMODULATOR -- 400871-001
RESPIRATION CARRIER -- 400870-001
ECG PREAMP (I,II,III,V/V1) -- 400869-004
ECG PREAMP II (V2-V6) -- 401790-001
PACE DETECT (MV)-- 2007009-001
PACE REJECT (I,II,III,V/V1) -- 401786-001
PACE REJECT (V2-V6) -- 401786-001
FINAL AMP (I,II,III,V/V1) -- 401787-001
FINAL AMP (V2-V6) -- 401787-001
TEMP CH1 -- 401788-004
TEMP CH2 -- 402100-004
PULSE-OXIMETRY (PCB Module)-- 2006148-001
4-IBP and SUPER BP -- 2013329-001
NBP CUFF PRESSURE SENSOR
(MOUNTED ON 801368-001 HYBRID)
BAROMETRIC PRESSURE SENSOR
CO2 SIGNAL PROCESSING & BARO PRESS -- 801368-001
CO2 IR SOURCE DRIVE / HEATER CONTROL -- 801370-001
VREF
MUX & A/D
11 PIN ECG INPUT CONNECTOR
DUAL TEMP/ CARDIAC OUTPUT
INV BP1/BP3
INV BP2/BP4
SpO2
NBP
ETCO2
DETAILED BLOCK DIAGRAM
DASH V5 4-IBP SuperStat
Data Acquisition
Rev A. 6/03/03 PRV
DDS 2014905-001

The DAS system block diagram with Masimo SET SPO2 and four SuperStat BP channels consists of the following three sections.

Section	Description
ECG/Respiration	Separately isolated section includes a 7.3728MHz Motorola MC68HSC705C8A microcontroller, A/D conversion, signal processing hybrids and DC-DC isolation converter.
Main DAS	Separately isolated section includes a 22.1184MHz Motorola MC68332 microcontroller with FLASH and SRAM memory, an Analog Devices ADSP-21062 32-bit floating point digital signal processor running at 12.096MHz, A/D conversion, signal processing hybrids/modules and DC-DC isolation converter.
Non-Isolated circuits	Includes ECG and Main DAS isolation power conversion circuitry, serial and parallel host interfaces and NBP pump, valves, and over-pressure circuitry.

Parameter Functions of the DAS with Masimo SET SPO2 and Four SuperStat BP Channels

Except for the SPO2 parameter, the DAS with the Masimo SET SPO2 parameter supports the same parameters as DAS with the GE SPO2 parameter. Refer to "ECG" on page 9-7.

Probes and Cable

The Masimo compatible DAS is intended for use exclusively with pulse-oximetry probes from Masimo Corporation. An adapter cable is used to interface the probes to the DAS front panel Nicolay connector. The Nicolay connector utilizes a key pattern unique to Masimo.

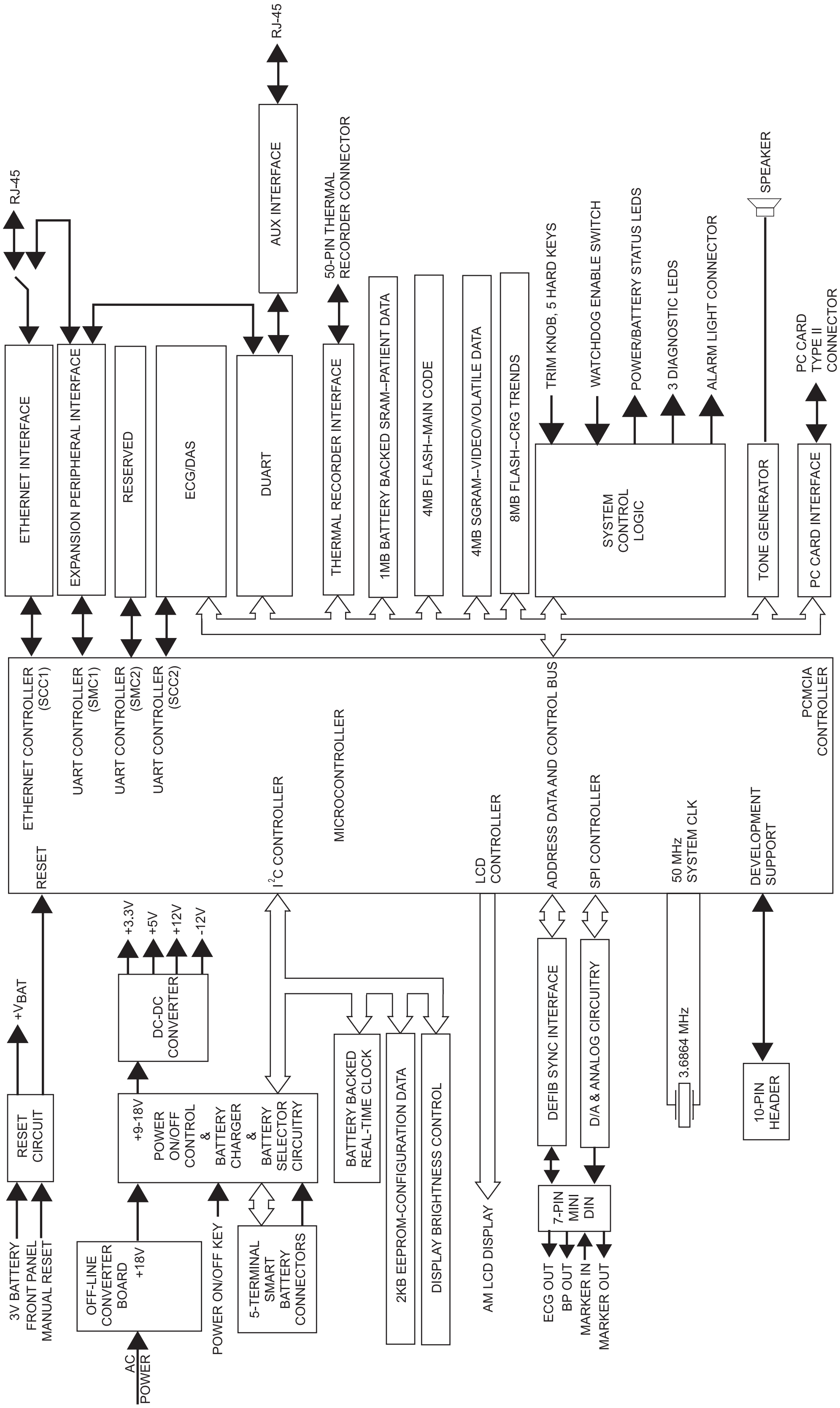
Processor/Power Management Subsystem

Overview

The main processor/power management PCB contains the electrical hardware to provide data processing and display of patient and monitor configuration data, communication and interface circuitry, and power conversion and battery management functions for the monitor.

The high level of integration attained in the design of the processor/power management PCB is attributed to the use of several highly integrated devices. A complex communications controller, ASIC, and battery management hardware significantly improve the performance and reduce the complexity and cost of the assembly. In addition to the CPU, the main microcontroller contains a six-channel communications processor as well as memory, PC Card, and video controllers. The devices used in the core processing architecture all operate at 3.3 V to minimize power consumption, yet the main processor and ASIC are tolerant of 5 V hardware peripherals.

Block Diagram


RJ-45
RJ-45
AUX INTERFACE
50-PIN THERMAL RECORDER CONNECTOR
SPEAKER
TRIM KNOB, 5 HARD KEYS
WATCHDOG ENABLE SWITCH
POWER/BATTERY STATUS LEDS
3 DIAGNOSTIC LEDS
ALARM LIGHT CONNECTOR
PC CARD TYPE II CONNECTOR
ETHERNET INTERFACE
EXPANSION PERIPHERAL INTERFACE
RESERVED
ECG/DAS
DUART
THERMAL RECORDER INTERFACE
1MB BATTERY BACKED SRAM--PATIENT DATA
4MB FLASH--MAIN CODE
4MB SGRAM--VIDEO/VOLATILE DATA
8MB FLASH--CRG TRENDS
SYSTEM CONTROL LOGIC
TONE GENERATOR
PC CARD INTERFACE
ETHERNET CONTROLLER (SCC1)
UART CONTROLLER (SMC1)
UART CONTROLLER (SMC2)
UART CONTROLLER (SCC2)
MICROCONTROLLER
ADDRESS DATA AND CONTROL BUS
PCMCIA CONTROLLER
RESET
I2C CONTROLLER
LCD CONTROLLER
SPI CONTROLLER
50 MHz SYSTEM CLK
DEVELOPMENT SUPPORT
+VBAT
+3.3V
+5V
+12V
-12V
DC-DC CONVERTER
RESET CIRCUIT
+9-18V
POWER ON/OFF CONTROL & BATTERY CHARGER & BATTERY SELECTOR CIRCUITRY
BATTERY BACKED REAL-TIME CLOCK
2KB EEPROM-CONFIGURATION DATA
DISPLAY BRIGHTNESS CONTROL
AM LCD DISPLAY
DEFIB SYNC INTERFACE
D/A & ANALOG CIRCUITRY
3.6864 MHz
10-PIN HEADER
7-PIN MINI DIN
ECG OUT
BP OUT
MARKER IN
MARKER OUT
3V BATTERY
FRONT PANEL MANUAL RESET
OFF-LINE CONVERTER BOARD
+18V
AC POWER
POWER ON/OFF KEY
5-TERMINAL SMART BATTERY CONNECTORS

Main Microcontroller

The microcontroller contains two processors:

- a true internal and external 32-bit CPU core, and
- a communications processor module (CPM).

The CPM contains an 8 Kb dual port RAM to communicate with the CPU core, and once configured communicates with external devices with minimum CPU intervention. External logic is reduced by the internal memory controllers and a system interface unit which provides a clock synthesizer and timers used in this design. Writer communications is supported by direct memory access and processing performance is enhanced by 4-kilobyte instruction and data caches.

Microcontroller Feature	Monitor Function
Serial Communications Controller 1	Unity Network
Serial Communications Controller 2	DAS communication
Serial Management Controller 1	Peripheral expansion communication
Serial Management Controller 2	Reserved
Interprocessor-Integrated Controller	Batteries, battery charger, Real-time clock, EEPROM, digital potentiometer for display brightness control
Serial Peripheral Interface	DAC for ECG and BP analog outputs; ASIC configuration
User Programmable Machine A	Memory controller for synchronous graphics RAM
User Programmable Machine B	Memory controller for synchronous flash
General-Purpose Chip-Select Machine	Memory and peripheral device control
LCD Controller	Color display
PC Card Controller	Future use
DMA	Writer communication
System Phase-Locked Loop (SPLL)	Generation of system clock from crystal oscillator

Microprocessor Supervisory Circuit, Microcontroller Internal Watchdog Timer

The microprocessor supervisory circuit provides reliable operation of the main processor board. This circuit monitors the +3.3 V power supply and asserts a 140 mS active low reset pulse when the power supply voltage is below +3.0 V during power-up and power-down conditions. A 3 V, 0.5 A hour lithium battery is used to preserve the contents of two SRAM devices and a real-time clock (RTC) when VCC is below the reset threshold.

System Control Logic

The system ASIC contains all of the system control logic for the processor/power management PCB. Such functions include address decoding, peripheral read and write control strobes, smart battery control logic, display control, multiple I/O ports, and front panel key switch debouncing.

Memory

Eight Mb of non-volatile memory are provided to support the boot code and expansion memory such as high resolution graphic trends data storage. The 512 Kb boot block is write protected.

Four Mb of non-volatile memory are provided to support the main software application code.

Four Mbytes of volatile memory are provided by the synchronous graphics RAM. This memory is used for stack, variable storage, dynamically allocated memory and video data storage.

One Mb of battery-backed SRAM supports storage of 24 hours of 1-minute resolution patient trends, an error log containing 50 input errors, and 50 output errors and storage for the CPM buffers.

The monitor configuration data such as Internet and Ethernet addresses, unit name and bed number are maintained in the 2 Kb EEPROM. The serial device resides on the I^2C bus.

Real-Time Clock

The real-time clock incorporates an on-board quartz crystal. This feature simplifies the design and eliminates adjustments. The time of day is maintained to an accuracy of 15 seconds in 24 hours to support 24 hour trend data. The RTC device is one of the devices on the I^2C bus.

Audio Subsystem

Audio tones are generated using a tone generator, an audio amplifier, and an 8Ω, 2.5-in. speaker. The tone generator has built in D/A converters and a mixer to generate the dual frequency tones. Frequencies ranging from 150 Hz to 2800 Hz are produced.

Video Subsystem

The microprocessor contains a video controller that supports real-time and non-real-time waveform drawing, menu drawing, and parameter display.

Display brightness is controlled by a 50 kΩ digital potentiometer. The potentiometer is interfaced to the brightness control input of an inverter.

Analog Outputs

Two analog output channels support ECG and BP. The pace pulse is generated on the main processor board and inserted into the analog out ECG signal. The digital-to-analog conversion for both ECG and blood pressure output signals are performed on the main processing board via a two channel 12-bit serial DAC. Cal data is stored on the processor/ power management PCB.

Defib Sync

The QRS complex of ECG data acquired from the DAS generates the marker-out signal. A software selectable pulse width and pulse amplitude is provided in the Boot Loader Menu.

Optional Thermal Printer

The thermal printer includes complete control of the print head to print the desired waveforms and text as well as monitor power consumption. The host processor on the main processing board has direct communication via an 8-bit data bus to the processor residing within the thermal recorder.

The +9-18 V power supplied to the writer is heavily filtered to provide the storage capability to smooth power surges and transients caused by abnormal thermal printing. Such printing may occur if the monitor is subjected to ESU noise. In addition, a writer current limiting circuit restricts the current to the writer to 2.5 A. If this current limit is exceeded, the circuit faults and requires the current limiting circuit to reset through a microprocessor port.

Optional Alarm Light Indicator

An alarm light indicating two levels of visual alarms resides in the handle of the Dash 3000 monitor and in the display bezel of the Dash 4000 monitor. Red and yellow alarm lights illuminate by addressing an ASIC output port. The Dash 3000 alarm light interfaces to the processor/ power management PCB via the 40-pin writer interface. The Dash 4000 alarm light interfaces to the processor/power management PCB via the 100-pin DAS/Display /Keyboard interface.

PC Card

The main processor contains a PC Card controller, which complies with the PCMCIA standard. One 68-pin fully compliant Type II PC Card slot is supported in this design for RF LAN.

Peripheral Expansion Interface

A 20-pin peripheral expansion interface is provided to support future use. An active low peripheral present signal may be polled by software to identify when a peripheral is attached to the monitor. Asynchronous, AUX, and a switched Ethernet serial communication channels are supported as well as switched +9-18 V and +5 V power.

DAS Communication

The microprocessor communicates with the DAS processor using the second serial communication controller (SCC) of the communication processor module (CPM). This asynchronous communication channel operates at TTL levels and is optically isolated within the DAS.

Optional Unity Network Communication

The microprocessor provides an Ethernet controller, which is implemented on SCC1 in order to benefit from the additional buffer descriptors compared to SCC2. Ethernet packets are stored in SRAM buffers and are transmitted and received by the 10BASE-T transceiver. The Ethernet clocks are generated from a 20 MHz crystal oscillator circuit and the transceiver. The transceiver also provides a visual indication in the form of four LEDS to identify packet transmit, receive, collision, and link integrity. The status of received data is indicated by the link integrity signal, which is used by the microprocessor to determine if the monitor is connected to the Unity Network.

An isolation transformer provides basic insulation to the twisted pair interface required to meet the ANSI/IEEE 802.3 standard (Ethernet). Isolation is required because during transport the power cord with the ground conductor is not available to provide a path for a fault condition. An 8-pin RJ-45 connector containing two isolated, differential pairs is provided to connect the monitor to a network hub.

NOTE

> Power is not provided in the twisted pair interface as in the attachment user interface (AUI) of other monitoring products.

Ethernet Priority

Ethernet communications are prioritized in the following order.

1. Top priority is the Peripheral Expansion interface
2. Next priority is the Hardwired Ethernet connection at the back of the monitor.
3. Lowest priority is the optional Wireless LAN.

If none of the above exist, then the monitor is a stand-alone monitor.

Async Communication

Two asynchronous communication ports comply with the GEMMS AutoPort protocol and are provided through an 8-pin RJ-45 connector and the 20-pin peripheral interface described in the next section.

Debug Monitor and Diagnostic LEDs

An integrated debugger operating in the debug mode within the main processor provides basic emulator-like features such as modification of register and memory locations and setting of breakpoints. The connector required for this serial communication is a dual row 10-pin header. This connector is located within the monitor and is not intended for field service use. Tracing of instructions and logic analysis is provided by an adapter board that connects to a socket installed on the main processor board instead of the microprocessor.

Three diagnostic LEDs located along the front edge of the board are provided for general purpose use and are under software control. The LEDs interface directly to port A of the microprocessor. A flashing green LED indicates normal monitoring operation.

Main DC-DC Converter Section

The main DC-DC converter consists of two independent synchronous rectifier buck regulators with one common controller.

The monitor uses a “point of use” power conversion architecture with +9-18 V being the main power distribution bus.

Four voltage outputs are developed on the processor/power management PCB:

- +3.3 V,
- +5 V,
- +12 V, and
- –12 V.

Each one of the four outputs are individually current limit protected against overload and short circuit.

Battery Subsystem

Battery charging and control is accomplished on the processor/power management PCB.

The battery is a smart battery and features an on-pack fuel gauge.

Optional Thermal Printer

The monitor uses the same 50-mm thermal printer module that is used in the PRN 50 stand-alone printer. It prints up to four waveforms at chart speeds ranging from 0.1 to 50 mm/s. The printer software is loaded independently from the monitor’s software.

In the monitor, the printer module limits its current consumption to stay within its allocated system power budget.

Speaker

The speaker is used for audible notification of alarms.

Handle Subassembly

The handle serves multiple purposes in the monitor. The modular design enables the user to add adapters for specialized applications.

The Dash 3000 handle houses the optional alarm light. This light is visible for 360° surrounding the monitor. The light is intended for applications when the audible notification is not useful or effective, such as noisy environments (e.g., emergency vehicles) or quiet environments (e.g., neonatal care areas). The alarm light indicates two levels of visual alarms:

- Crisis alarms (red LED) and
- Warning alarms (amber LED).

The handle also houses the two RF LAN antennas required for the optional RF LAN subsystem.

Interfaces

Ethernet

The Ethernet RJ-45 connector provides a hardware connection to the optional Unity Network. The monitor has a built-in transceiver for twisted-pair wire. Basic insulation (1500 VAC) isolates the monitor from networked devices.

AUX

The AUX RJ-45 connector provides an asynchronous communication connection to devices within the bedside care area. Basic insulation (1500 VAC) isolates the monitor from other devices.

Defib Sync

The Defib Sync connector provides signals needed to perform synchronized cardioversion with a defibrillator. The Marker Out signal is a pulse with selectable amplitude and width that coincides with the patient's ECG R-wave. The Marker In signal is returned to the monitor by the defibrillator. The Marker In signal causes the monitor to insert a defib marker in the displayed ECG waveform.

This connector also provides two analog signals: ECG and invasive pressure. The monitor provides the top displayed ECG signal with reconstructed pace pulses. You can use this signal to trigger a defibrillator or intra-aortic balloon pump. BP1 produces the pressure signal and is intended for triggering an intra-aortic balloon pump.

Peripheral Expansion

A port is provided for expansion. Asynchronous communication, Ethernet (shared with the Ethernet RJ-45 connector), 9-18 V power, 5 V power, and discrete I/O signals are provided in the interface. The expansion connector pairs with the AC mains power inlet to supply power to the monitor through a peripheral device.

Setup and Configuration

Program Code Storage

Executable program code for the main processor, DAS processor, and thermal printer are stored in non-volatile programmable memory. Program code can be changed via the AUX port using the PC-based TCCM Update software utility or via the optional Unity Network (Ethernet port) from a file server supporting the Xfiles protocol.

To display the revision of the currently stored code, access the submenu of the main application's Monitor Setup menu.

Monitor Settings

The processor/power management PCB stores default monitor settings in non-volatile memory. The user must restore the original settings if replacing the board.

Patient Data Storage

Static RAM backed up by a lithium battery soldered onto the processor/power management PCB stores patient data.

Time and Date

The monitor maintains time and date for at least five years. Time is accurate to within one second in ten hours. The clock is synchronized with a time master on the optional Unity Network.

Calibration Data

Calibration factors for NBP and CO_2 are stored in non-volatile memory on the DAS board.

Calibration factors for the analog output signals are stored in non-volatile memory on the processor/power management PCB.

Error Log

50 input errors and 50 output errors are retained in static RAM backed up by a lithium battery soldered onto the processor/power management PCB. Contents are retained for at least five years, provided that you exercise caution when you handle the board to prevent inadvertently discharging the battery (e.g. when you ship the board for problem diagnosis).

Ordering Parts

The parts lists and assembly drawings in this chapter supply enough detail for you to order parts for the assemblies considered field serviceable. If you require additional information or troubleshooting assistance, contact Technical Support.

To order parts, contact Service Parts at the address or telephone number listed on the “How to Reach Us...” page found in the front of this manual.

Service Parts

Field Replaceable Units (FRUs)

Parts List - GE DAS Assembly FRU PN 2013114-015, Rev. C

Item Description	Qty	Additional FRU Requirements
FRU DASH 3K / 4K MISC HARDWARE	1	
LABEL FRU/UPG DASH MASIMO 2BP SUPERSTAT	1	
INSTR FIELD REPLACEMENT UNIT ENG	1	
ASSY DAS DASH 3000	1	Need software revision.

Parts List - Masimo DAS 4BP SuperStat Assembly FRU PN 2013114-022, Rev. A

Item Description	Qty	Additional FRU Requirements
FRU DASH 3K / 4K MISC HARDWARE	1	
LABEL- FRU/UPG DASH MASIMO 4BP SUPERSTAT	1	
INSTR FIELD REPLACEMENT UNIT ENG	1	
ASSY DASH DAS MASIMO 4BP SUPERSTAT	1	Requires a software revision. Minimum Dash software version required is V5. If you load a Dash software version earlier than V5, the monitor will be rendered useless.

Parts List - Dash Silicone Battery Doors w/Frame FRU PN 2013114-023, Rev. A

Item Description	Qty	Additional FRU Requirements
SCREW MACH PNHD M2X16LG WITH THD LOCK	3	
DASH BATTERY DOOR FRAME	1	
DASH BATTERY DOOR A	1	
DASH BATTERY DOOR B	1	

Other Replaceable Components

* Indicates what is needed when ordering these components from customer service.

Dash 3000/4000 Monitor

The following components are compatible with the Dash 3000 and the Dash 4000 monitors.

Item Number	Item Description	Qty	Comments
421071-001	3V LITHIUM BATTERY PCB MOUNTED	1	Used on Processor/Power Management Assembly.
419068-005	11.1V LITHIUM ION BATTERY	1	
2015995-001	PROCESSOR/POWER MANAGEMENT ASSEMBLY (INCLUDES RF LAN CONNECTOR)	1	* Requires a software revision and installed options. Minimum software version required is V4C. If you load a Dash software version earlier than V 4C, the monitor will be rendered useless.
419477-001	POWER SUPPLY	1	
419473-003	2-INCH WRITER ASSEMBLY	1	* Requires writer software version 3 or higher.
2000976-001	NBP ASSEMBLY	1	
2003108-001	RF LAN CARD	1	
2005772-001	DUAL BP CABLE MASIMO 4BP	1	

Dash 3000/4000 Monitor Labels

Item Number	Item Description	Qty	Comments
2018547-001	LABEL KIT DASH 3000/4000 ENG	1	This is the complete lable kit for Dash 3000/4000.
2018547-002	LABEL KIT DASH 3000/4000 GER	1	
2018547-003	LABEL KIT DASH 3000/4000 FRE	1	
2018547-004	LABEL KIT DASH 3000/4000 SWE	1	
2018547-005	LABEL KIT DASH 3000/4000 SPA	1	
2018547-006	LABEL KIT DASH 3000/4000 ITA	1	
2018547-007	LABEL KIT DASH 3000/4000 DUT	1	
2018547-008	LABEL KIT DASH 3000/4000 DAN	1	
2018547-009	LABEL KIT DASH 3000/4000 NOR	1	
2018547-010	LABEL KIT DASH 3000/4000 JPN	1	
2018547-011	LABEL KIT DASH 3000/4000 POR	1	
2018547-012	LABEL KIT DASH 3000/4000 RUS	1	
2018547-013	LABEL KIT DASH 3000/4000 CHI	1	
2018547-014	LABEL KIT DASH 3000/4000 HUN	1	
2018547-015	LABEL KIT DASH 3000/4000 POL	1	
2018547-016	LABEL KIT DASH 3000/4000 CZE	1	
2018547-017	LABEL KIT DASH 3000/4000 GRE	1	
2019181-001	LABEL FRU/UPG DASH MASIMO 4BP SUPERSTAT	1	Masimo DAS labels.
2019181-002	LABEL FRU/UPG DASH MASIMO 2BP SUPERSTAT	1	

Dash 3000 Monitor

The following components are compatible with the Dash 3000 monitor.

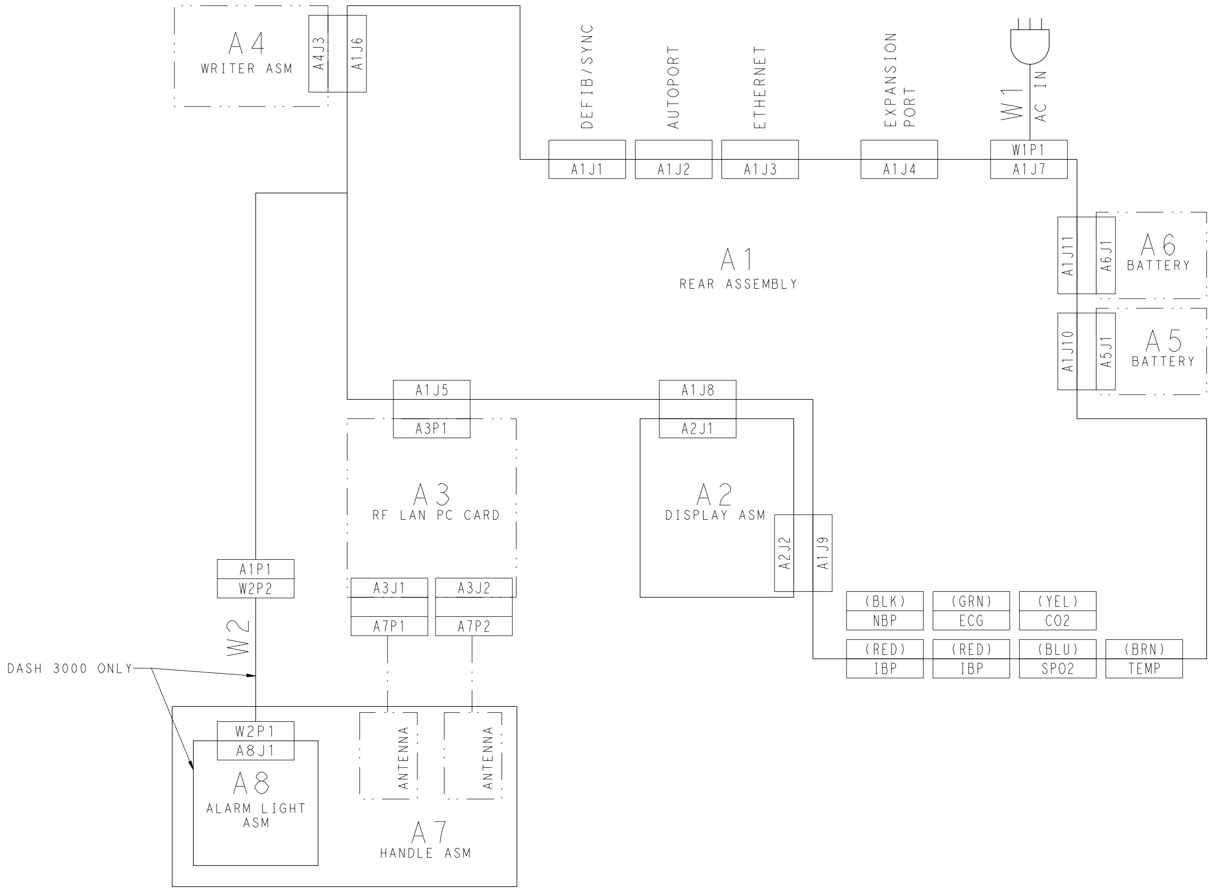
Item Number	Item Description	Qty	Comments
2015617-002	DISPLAY ASSEMBLY (DASH 3000)	1	Order lablels seperately.
418957-002	KEYPAD ASSEMBLY (DASH 3000)	1	
414622-001	TRIM KNOB	1	
2000516-001	CLIP ELECTRICAL GROUNDING	1	
422429-001	BACKLIGHT INVERTER (DASH 3000)	1	

Dash 4000 Monitor

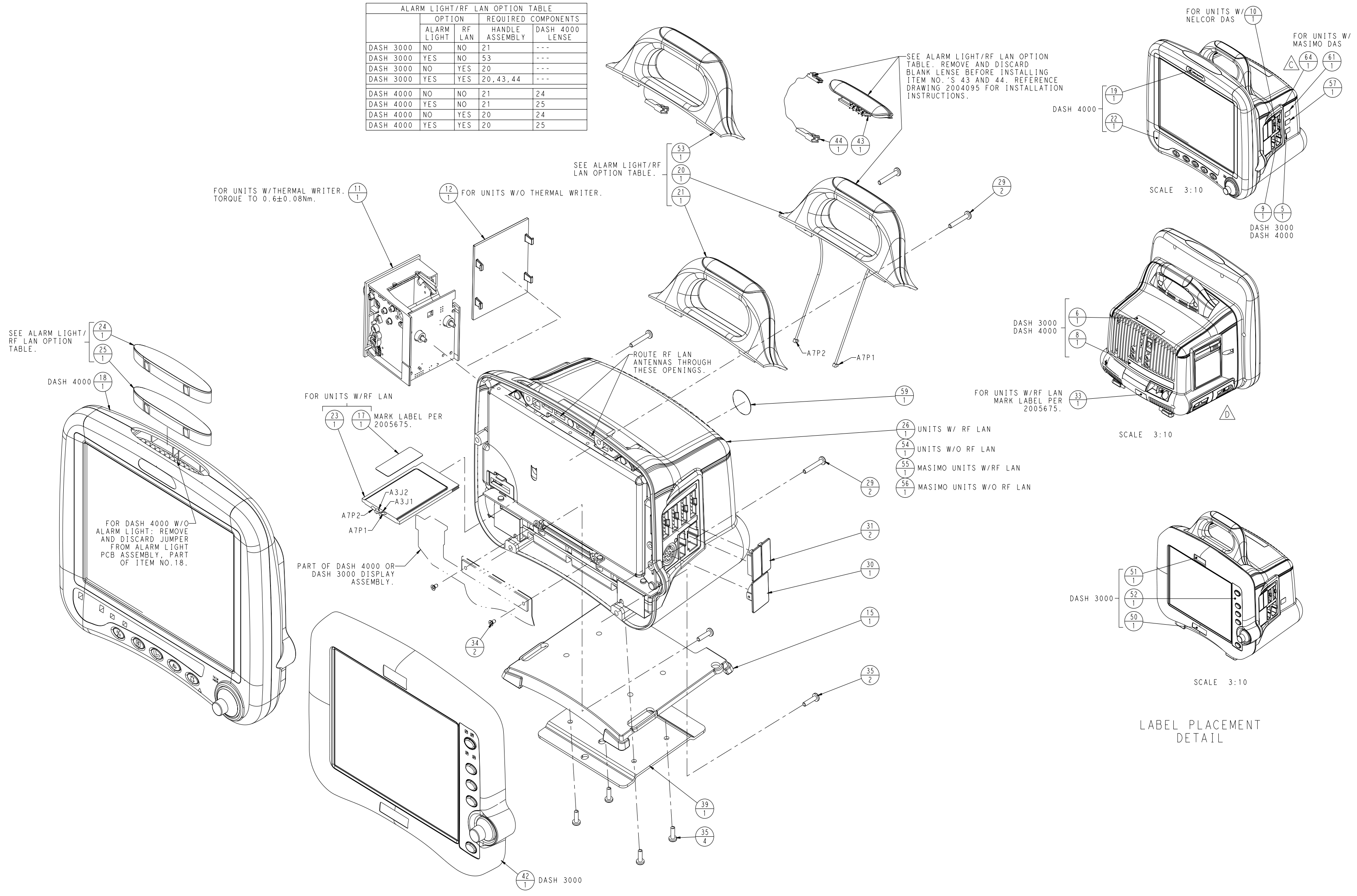
The following components are compatible with the Dash 4000 monitor.

Part Number	Description	Qty	Comments
2015618-002	DISPLAY ASSEMBLY	1	Order labels separately. Need software version 3D or later.
2002220-001	KEYPAD ASSEMBLY	1	
406080-001	TRIM KNOB	1	
2003610-001	CLIP ELECTRICAL GROUNDING	1	
2004019-001	BACKLIGHT INVERTER	1	
2004229-001	ALARM LIGHT	1	

Interconnection Diagram PN 2015999, Rev. D


A4
WRITER ASM
A4J3
A1J6
DEFIB/SYNC
AUTOPORT
ETHERNET
EXPANSION PORT
W1
AC IN
A1J1
A1J2
A1J3
A1J4
W1P1
A1J7
A1
REAR ASSEMBLY
A1J11
A6J1
A6
BATTERY
A1J10
A5J1
A5
BATTERY
A1J5
A3P1
A1J8
A2J1
A3
RF LAN PC CARD
A2
DISPLAY ASM
A2J2
A1J9
A1P1
W2P2
A3J1
A3J2
A7P1
A7P2
(BLK)
NBP
(GRN)
ECG
(YEL)
CO2
(RED)
IBP
(RED)
IBP
(BLU)
SPO2
(BRN)
TEMP
W2
DASH 3000 ONLY
W2P1
A8J1
A8
ALARM LIGHT ASM
ANTENNA
ANTENNA
A7
HANDLE ASM

Dash 3000/4000 Assembly PN 2015999, Rev. D



ALARM LIGHT/RF LAN OPTION TABLE				
	OPTION		REQUIRED COMPONENTS	
	ALARM LIGHT	RF LAN	HANDLE ASSEMBLY	DASH 4000 LENSE
DASH 3000	NO	NO	21	---
DASH 3000	YES	NO	53	---
DASH 3000	NO	YES	20	---
DASH 3000	YES	YES	20,43,44	---
DASH 4000	NO	NO	21	24
DASH 4000	YES	NO	21	25
DASH 4000	NO	YES	20	24
DASH 4000	YES	YES	20	25

SEE ALARM LIGHT/RF LAN OPTION TABLE. REMOVE AND DISCARD BLANK LENSE BEFORE INSTALLING ITEM NO.'S 43 AND 44. REFERENCE DRAWING 2004095 FOR INSTALLATION INSTRUCTIONS.

FOR UNITS W/THERMAL WRITER. TORQUE TO 0.6±0.08Nm.

FOR DASH 4000 W/O ALARM LIGHT: REMOVE AND DISCARD JUMPER FROM ALARM LIGHT PCB ASSEMBLY, PART OF ITEM NO.18.

ROUTE RF LAN ANTENNAS THROUGH THESE OPENINGS.

PART OF DASH 4000 OR DASH 3000 DISPLAY ASSEMBLY.

FOR UNITS W/RF LAN MARK LABEL PER 2005675.

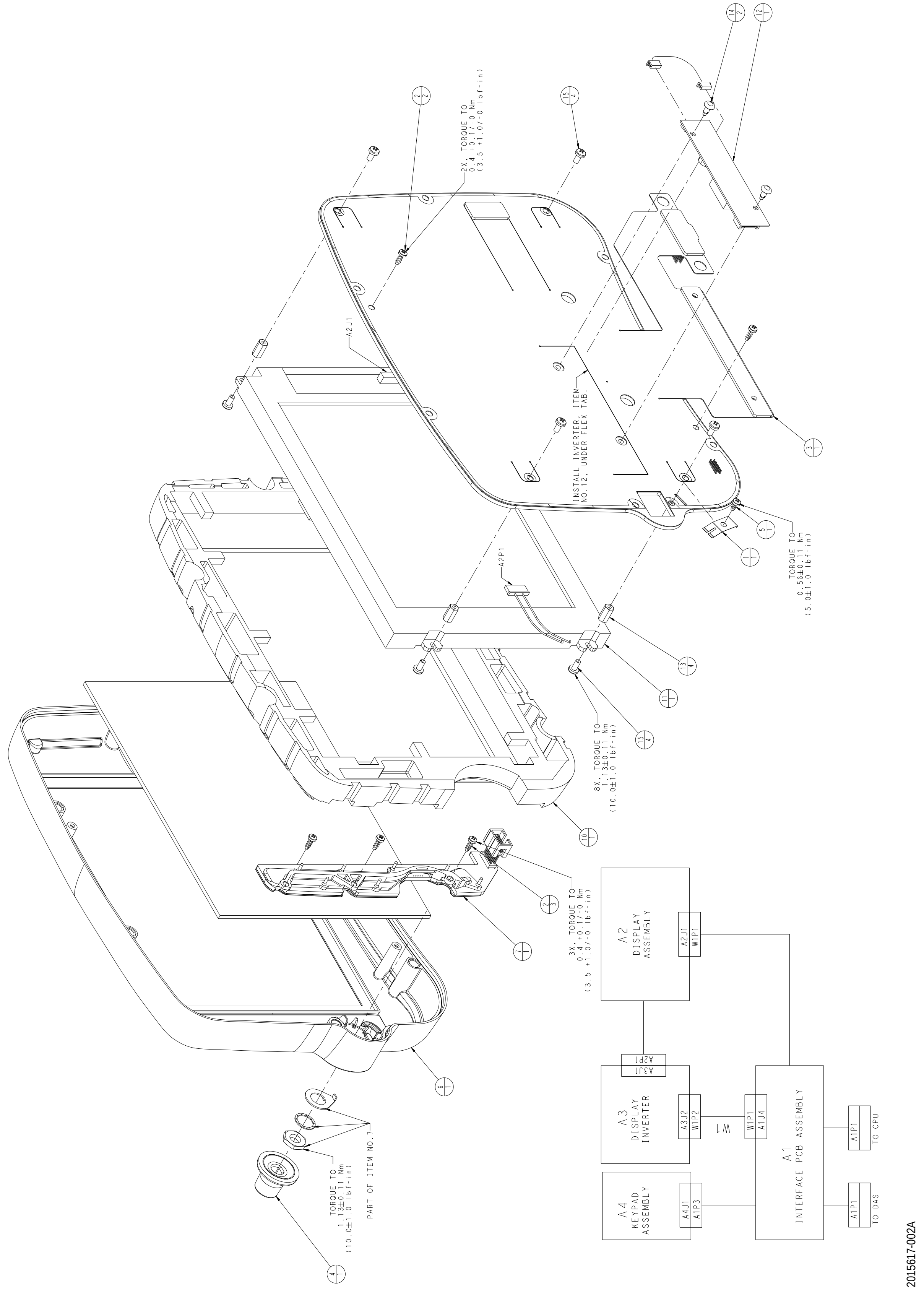
FOR UNITS W/ NELCOR DAS 10/1
FOR UNITS W/ MASIMO DAS
C 64/1
61/1
57/1
DASH 4000 19/1 22/1
9/1 5/1 DASH 3000 DASH 4000
SCALE 3:10
DASH 3000 DASH 4000 6/1 8/1
33/1
D
SCALE 3:10
DASH 3000 51/1 52/1 50/1
SCALE 3:10
LABEL PLACEMENT DETAIL
44/1 43/1
29/2
SEE ALARM LIGHT/RF LAN OPTION TABLE. 53/1 20/1 21/1
A7P2
A7P1
59/1
26/1 UNITS W/ RF LAN
54/1 UNITS W/O RF LAN
55/1 MASIMO UNITS W/RF LAN
56/1 MASIMO UNITS W/O RF LAN
29/2
31/2
30/1
15/1
35/2
39/1
35/4
42/1 DASH 3000
11/1
12/1 FOR UNITS W/O THERMAL WRITER.
SEE ALARM LIGHT/ RF LAN OPTION TABLE. 24/1 25/1
DASH 4000 18/1
FOR UNITS W/RF LAN 23/1 17/1 MARK LABEL PER 2005675.
A3J2
A3J1
A7P2
A7P1
34/2

Parts List PN 2015999, Rev. F

Find Number	Part Number	Item Description	Reference Designator	Qty
1	9402 SAMPLE-O46	PAPER SAMPLE NO GRD 50MMX100FR		1
2	80274-103	CORD PWR 125V 6FT RA TO5	W1	1
3	422774-026	PACKAGING CARTON 14 X 12.81 X 17.25		1
5	422487-001	LABEL 12SL .007 POLYCARBONATE	*	0
6	422482-001	LABEL PRESCRIPTION DEVICE .007	*	0
8	422324-001	LABEL DASH CONN/UL/CE	*	0
9	422323-001	LABEL DASH 3000 CONN CO2	*	0
10	422322-001	LABEL DASH 3000 CONN BP	*	0
11	419743-003	THERMAL PRINTER 50MM CS2	A4	1
12	419378-001	COVER SIDE DASH WO/WRITER		1
13	419068-005	BATTERY RECHGR LITHIUM DASH TRANSPORT PRO	A5,A6	2
14	2020835-002	LABEL PRODUCT/SERIAL/MFG LOCATION SIZE B		1
15	421877-001	FOOT PAD DASH 3000/4000		1
16	4013548-002	INSERT PACKAGING DASH 3000 RH / 4000 LH		1
17	404525-020	LABEL BLANK 63.5 (2.50) X 31.8 (1.25)		1
18	2015618-002	ASSY DASH 4000 DISPLAY	A2	1
19	2004252-001	LABEL DASH 4000 PRODUCT MARK	*	0
20	2004095-003	ASSY DASH HANDLE W/O LIGHT W/ANTENNA	A7	1
21	2004095-001	ASSY DASH HANDLE W/O LIGHT W/O ANTENNA		1
22	2008907-001	LABEL DASH 4000 FR PNL ENG	*	0
23	2003108-001	CARD PCMCIA 100MW SPECTRUM24 W/LAN ADPTR	A3	1
24	2002218-002	LENSE DASH 4000 OPAQUE		1
25	2002218-001	LENSE DASH 4000 ALARM LIGHT		1
26	2015997-001	ASSY DASH 3K/4K REAR W/RFLAN	A1	1
27	2013566-001	INSERT SHIPPING DASH 3-4K BATTS/PAPER		1
29	2000543-001	SCREW MACH PNHD M4X25LG SST W/THD LOCK		4
30	2000462-002	COVER DASH C02 CONN		1
		*Order the complete label kit (PN 2018547).		

Find Number	Part Number	Item Description	Reference Designator	Qty
31	2000462-001	COVER DASH PATIENT CONNECTOR		2
32	422519-053	LABEL CARTON DASH 4000		1
33	404525-008	LABEL BLANK 1.2IN X .6IN		1
34	2001075-001	SCREW MACH FLHD M3X6LG SS W/THD LK		2
35	2000546-005	SCREW MACH PNHD M4 X 14LG SST W/THD LOCK		6
36	2013548-001	INSERT PACKAGING DASH 3000 LH / 4000 RH		1
37	2000966-271	CD SVCE MNL DASH 3000/4000 V5 ENG		1
38	2000966-269	MNL OPR DASH 3000/4000 V5 ENG		1
39	420001-001	PLATE MOUNT GCX DASH		1
41	99014-001	BAG INTISTATIC POLY 18 X 20		1
42	2015617-002	ASSY DASH 3000 DISPLAY	A2	1
43	422195-093	ASM DASH 3000 ALARM LIGHT	A8	1
44	2004087-001	CABLE ASSY DASH ALARM LITE JUMPER	W2	1
49	422159-013	LABEL CARTON DASH 3000		1
50	2005876-001	LABEL GE .007 POLYCARBONATE	*	1
51	2005878-001	LABEL PRODUCT MARK DASH 3000	*	1
52	2008906-201	LABEL DASH 3000 FR PNL ENG	*	1
53	2004095-002	ASSY DASH HANDLE W/LIGHT W/O ANTENNA		1
54	2015997-002	ASSY DASH 3K/4K REAR WO/RFLAN		1
55	2015997-003	ASSY DASH 3K/4K REAR W/RFLAN MASIMO		1
56	2015997-004	ASSY DASH 3K/4K REAR WO/RFLAN MASIMO		1
57	2008631-001	LABEL DAS MASIMO	*	0
58	2000966-267	CD SVCE MNL JAPAN DASH 3000/4000 V5 ENG		1
59	2011333-001	LABEL DASH CASTING GATE PAD		1
61	2018519-001	LABEL DASH 3000/4000 MASIMO SUPERSTAT	*	0
62	2015997-005	ASSY DASH 3K/4K REAR W/RFLAN MASIMO 4BP SUPERSTAT		1
63	2015997-006	ASSY DASH 3K/4K REAR WO/RFLAN MASIMO 4BP SUPERSTAT		1
64	2018518-001	LABEL DASH 3000 CONN BP1/3 - BP2/4 MASIMO SUPERSTAT	*	0
		*Order the complete label kit (PN 2018547).		

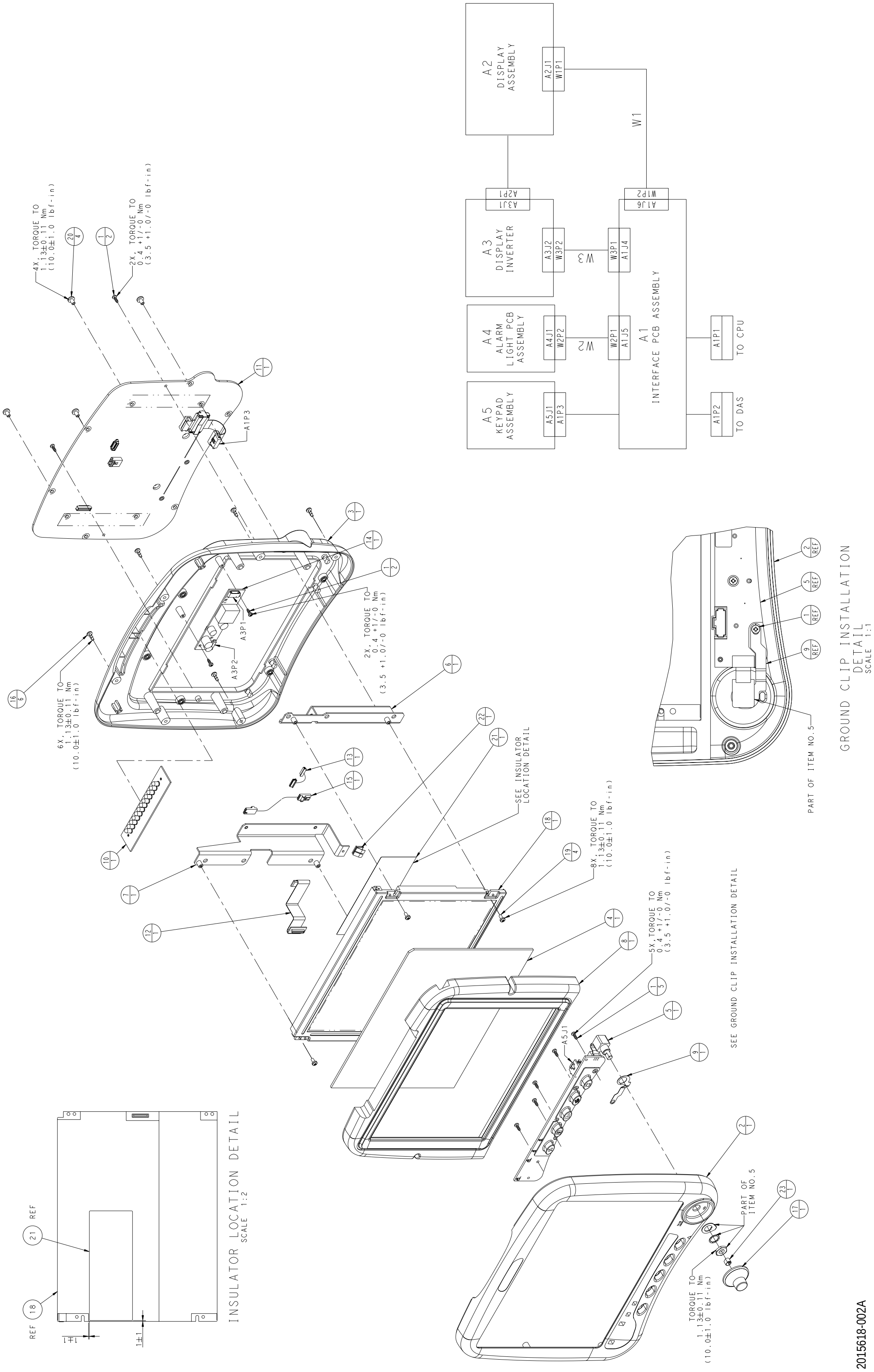
Dash 3000 Display Assembly PN 2015617-002, Rev. A


14 2
12 1
2 2
2X, TORQUE TO 0.4 +0.1/-0 Nm (3.5 +1.0/-0 lbf-in)
15 4
A2J1
INSTALL INVERTER, ITEM NO.12, UNDER FLEX TAB.
3 1
5 1
1 1
TORQUE TO 0.56±0.11 Nm (5.0±1.0 lbf-in)
A2P1
13 4
11 1
15 4
8X, TORQUE TO 1.13±0.11 Nm (10.0±1.0 lbf-in)
10 1
2 3
3X, TORQUE TO 0.4 +0.1/-0 Nm (3.5 +1.0/-0 lbf-in)
7 1
6 1
PART OF ITEM NO.7
TORQUE TO 1.13±0.11 Nm (10.0±1.0 lbf-in)
4 1
A2 DISPLAY ASSEMBLY
A2J1
W1P1
A2P1
A3J1
A3 DISPLAY INVERTER
A3J2
W1P2
W1
W1P1
A1J4
A1 INTERFACE PCB ASSEMBLY
A1P1
TO CPU
A4 KEYPAD ASSEMBLY
A4J1
A1P3
A1P1
TO DAS
2015617-002A

Parts List PN 2015617-002, Rev. A

Find Number	Part Number	Item Description	Reference Designator	Qty
1	2000516-001	CLIP ELECTRICAL GROUNDING		1
2	2000905-001	SCREW TAPPING TC SST #4X.31 HI-LO		5
3	2002393-002	FLEX DASH 3000 DISPLAY/SHIELD	A1	1
4	414622-001	TRIM KNOB		1
5	415870-001	SCREW 4-24X.25LG PH HI-LO TH		1
6	418633-001	BEZEL MONITOR		1
7	418957-002	ASSY DASH 3000 KEYPAD	A4	1
8	418961-001	FILTER DISPLAY		1
9	419557-001	CA ASSY DSPLY INVERTER DASH	W1	1
10	419214-001	ISOLATOR DASH LCD DISPLAY		1
11	419379-001	DISPLAY LCD DASH 21CM	A2	1
12	422429-001	INVERTER LCD BACKLIGHT LS380	A3	1
13	2004262-001	SPACER HEX FF M3 5MM HEX X 10		4
14	422585-002	RIVET SNAP 3X5.5MM NYLON BLK		2
15	2000540-001	SCREW MACH PNHD M3X6LG SST W/THD LOCK		8
16	412048-001	WASHER LOCK M3 EXT TOOTH		4

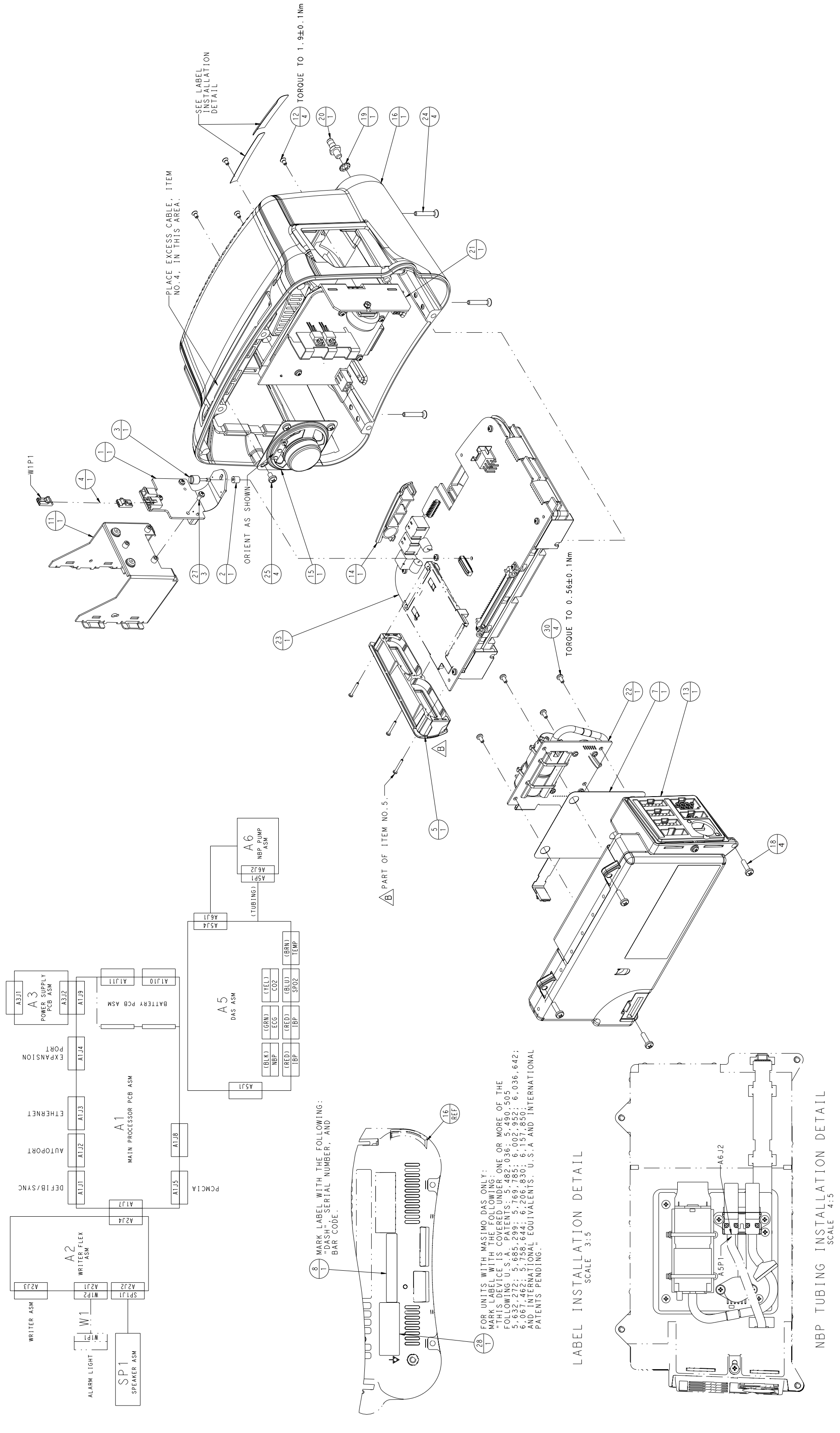
Dash 4000 Display PN 2015618-002, Rev. A


A2 DISPLAY ASSEMBLY
A2J1
W1P1
W1
A2P1
A3J1
W1P2
A1J6
A3 DISPLAY INVERTER
A3J2
W3P2
W3
W3P1
A1J4
A4 ALARM LIGHT PCB ASSEMBLY
A4J1
W2P2
W2
W2P1
A1J5
A1 INTERFACE PCB ASSEMBLY
A1P1
TO CPU
A5 KEYPAD ASSEMBLY
A5J1
A1P3
A1P2
TO DAS
4X, TORQUE TO 1.13±0.11 Nm (10.0±1.0 lbf-in)
20 4
1 2
2X, TORQUE TO 0.4 +1/-0 Nm (3.5 +1.0/-0 lbf-in)
11 1
A1P3
3 1
14 1
1 2
2X, TORQUE TO 0.4 +1/-0 Nm (3.5 +1.0/-0 lbf-in)
A3P1
A3P2
16 6
6X, TORQUE TO 1.13±0.11 Nm (10.0±1.0 lbf-in)
6 1
22 1
21 1
SEE INSULATOR LOCATION DETAIL
13 1
15 1
10 1
7 1
12 1
18 1
19 4
8X, TORQUE TO 1.13±0.11 Nm (10.0±1.0 lbf-in)
4 1
8 1
5X, TORQUE TO 0.4 +1/-0 Nm (3.5 +1.0/-0 lbf-in)
1 5
5 1
A5J1
9 1
SEE GROUND CLIP INSTALLATION DETAIL
2 1
PART OF ITEM NO.5
23 1
17 1
TORQUE TO 1.13±0.11 Nm (10.0±1.0 lbf-in)
2 REF
5 REF
1 REF
9 REF
PART OF ITEM NO.5
GROUND CLIP INSTALLATION DETAIL SCALE 1:1
21 REF
18 REF
1±1
1±1
INSULATOR LOCATION DETAIL SCALE 1:2
2015618-002A

Parts List PN 2015618-002, Rev. B

Find Number	Part Number	Item Description	Reference Designator	Qty
1	2000905-001	SCREW TAPPING TC SST #4X.31 HI-LO		9
2	2002161-001	BEZEL DASH 4000 FRONT		1
3	2002162-001	BEZEL DASH 4000 TRANSITION		1
4	2002210-001	FILTER OPT 26MM DISPLAY 1.6THK		1
5	2002220-001	PCB ASSY DASH 4000 KEYPAD	A5	1
6	2002272-001	BRACKET DASH 4000 26 DISP MT RT		1
7	2002272-002	BRACKET DASH 4000 26 DISP MT LEFT		1
8	2016383-001	INSERT DISPLAY DASH 4000		1
9	2003610-001	CLIP DASH 4000 TK GND		1
10	2004229-001	PCB DASH 4000 ALARM LIGHT	A4	1
11	2003768-002	PCB DASH 4000 FRONT PANEL	A1	1
12	2003784-001	PCB FLEX CKT DASH 4000 DISPLAY 31P	W1	1
13	2003791-002	CABLE ASSY DASH 4000 INVERTER	W3	1
14	2004019-001	POWER SPLY CCFL INVERTER VIN8-18V	A3	1
15	2004209-001	CABLE ASSY DASH 4000 ALARM LIGHT	W2	1
16	402440-001	SCREW PH PLASFORM #6-10 X .		6
17	406080-001	TRIM KNOB		1
18	416734-003	DISPLAY LCD 10.5 IN VGA COLOR TFT -46D NEC	A2	1
19	2000540-001	SCREW MACH PNHD M3X6LG SST W/THD LOCK		4
20	200546-001	SCREW MACH PNHD M4X6LG SST W/THD LOCK		4
21	404188-003	INSULATION DASH 3000 DISPLAY INVERTER		1
22	2000521-001	CLIP ELECTRICAL GROUNDING		1
23	4556-001	SPRING CLIP D TYPE .250 DIA		1

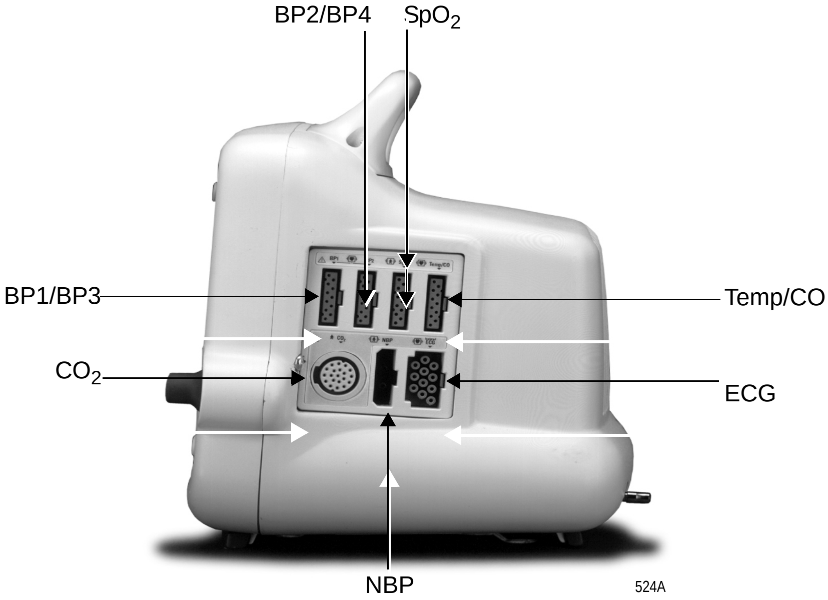
Dash 3000/4000 Back PN 2015997, Rev. B


SEE LABEL INSTALLATION DETAIL
TORQUE TO 1.9±0.1Nm
PLACE EXCESS CABLE, ITEM NO.4, IN THIS AREA.
W1P1
ORIENT AS SHOWN
TORQUE TO 0.56±0.1Nm
PART OF ITEM NO.5.
B
12 4
20 1
19 1
16 1
24 4
21 1
3 1
1 1
4 1
11 1
27 3
2 1
25 4
15 1
14 1
23 1
30 4
22 1
7 1
13 1
5 1
18 4
A6 NBP PUMP ASM
A6J2
A5P1
(TUBING)
A6J1
A5J4
(BRN) TEMP
(YEL) CO2
(BLU) SPO2
(GRN) ECG
(RED) IBP
(BLK) NBP
(RED) IBP
A5 DAS ASM
A5J1
A3J1
A3 POWER SUPPLY PCB ASM
A3J2
A1J9
A1J11
A1J10
BATTERY PCB ASM
EXPANSION PORT
A1J4
ETHERNET
A1J3
A1 MAIN PROCESSOR PCB ASM
AUTOPORT
A1J2
A1J8
DEFIB/SYNC
A1J1
A1J5
PCMCIA
A1J7
A2J4
A2 WRITER FLEX ASM
A2J3
A2J1
W1P2
A2J2
SP1J1
WRITER ASM
W1
W1P1
ALARM LIGHT
SP1 SPEAKER ASM
8 1
MARK LABEL WITH THE FOLLOWING: "DASH", SERIAL NUMBER, AND BAR CODE.
16 REF
28 1
FOR UNITS WITH MASIMO DAS ONLY: MARK LABEL WITH THE FOLLOWING: "THIS DEVICE IS COVERED UNDER ONE OR MORE OF THE FOLLOWING U.S.A. PATENTS: 5,482,036; 5,490,505 5,632,272; 5,685,299; 5,769,785; 6,002,952; 6,036,642; 6,067,462; 5,758,644; 6,206,830; 6,157,850; AND INTERNATIONAL EQUIVALENTS. U.S.A AND INTERNATIONAL PATENTS PENDING."
LABEL INSTALLATION DETAIL
SCALE 3:5
A6J2
A5P1
NBP TUBING INSTALLATION DETAIL
SCALE 4:5

Parts List PN 2015997, Rev. B

Find Number	Part Number	Item Description	Reference Designator	Qty
1	801536-001	FLEX ASM DASH 3000 THERMAL RECORDER	A2	1
2	422827-001	STANDOFF FEMALE 6MM RND 5MM LG		1
3	422826-001	SCREW CAPTIVE PANEL M3X.5X14.5		1
4	422647-001	CABLE ASM DASH ALARM LIGHT	W1	1
5	208213-001	DASH BATTERY DOOR		1
7	421955-003	INSULATOR DASH NBP PCB		1
8	404525-006	LABEL BLANK 2.6IN X.4IN		1
11	421263-003	BRACKET DASH WRITER MTG		1
12	2001075-001	SCREW MACH FLHD M3X6LG SS W/THD LK		4
13	2006933-001	ASSY DASH DAS MASIMO 4BP SUPERSTAT	A5	1
13	419723-001	ASSY GE DAS DASH 3000	A5	1
14	419577-001	PANEL CONNECTOR ISOLATOR DASH		1
15	419483-001	SPEAKER ASSEMBLY DASH	SP1	1
16	2006054-001	HOUSING REAR DASH 3000/4000		1
18	2000546-005	SCREW MACH PNHD M4 X 14LG SST W/THD LOCK		4
19	400041-001	WASHER LOCK SERRATED F/M-6		1
20	400040-001	PLUG MC EQUIPOTENTIAL		1
21	2004292-001	POWER SPLY DASH 3000/4000	A3	1
22	2000976-002	ASSY DASH 3000/4000 NBP	A6	1
23	2015995-001	ASSY DASH 3000/4000 BATT CPU W/RFLAN	A1	1
24	2000551-001	SCREW MACH FLHD M4X25LG SST W/THD LOCK		4
25	2000546-001	SCREW MACH PNHD M4X6LG SST W/THD LOCK		4
27	2000540-001	SCREW MACH PNHD M3X6LG SST W/THD LOCK		3
28	404525-001	LABEL BLANK 2 X 3/4		1
30	411373-002	SCREW PH KA30 X 8MM PT		4

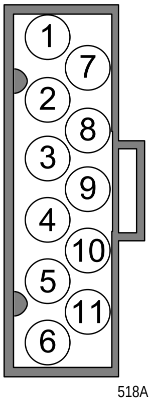
Port Connections



Invasive Blood Pressure Cable Connector

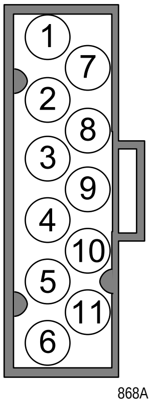
GE Blood Pressures

Two invasive blood pressure channels are provided; each channel uses a separate 11-pin, female connector. The pinout is as follows:

PIN	SIGNAL NAME	I/O	SIGNAL DESCRIPTION	DIAGRAM
1	BP_+VREF	O	BP transducer excitation voltage	
2	BP SIG+	I	BP transducer signal positive (+)	
3	NC	–	No connection	
4	AGND	O	Analog ground	
5	NC	–	No connection	
6	SHIELD	O	BP cable shield	
7	AGRND	O	Analog ground	
8	BP SIG1	I	BP transducer signal negative (–)	
9	NC	–	No connection	
10	BP1_ID	I	BP1 probe identification signal	
11	NC	–	No connection	

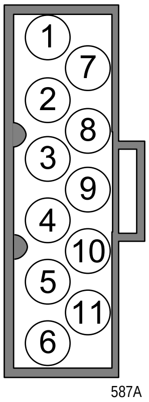
Masimo SuperStat Blood Pressures

Up to four invasive blood pressure channels are provided; each channel uses a separate 11-pin, female connector. The pinout is as follows:

PIN	SIGNAL NAME	I/O	SIGNAL DESCRIPTION	DIAGRAM
1	BP1_+VREF or BP2_+VREF	O	BP1 or BP2 transducer excitation voltage	 1 7 2 8 3 9 4 10 5 11 6 868A
2	BP SIG+	I	BP1 or BP2 transducer signal positive (+)	
3	BP1_+VREF or BP2_+VREF	O	BP1 or BP2 transducer excitation voltage	
4	AGND	O	Isolated ground	
5	INV_BP3SIG+ or INV_BP4SIG+	–	BP3 or BP4 transducer signal positive (+)	
6	SHIELD	O	BP cable shield	
7	ISO GND	O	Isolated ground	
8	BP SIG1 or BP SIG2	I	BP1 or BP2 transducer signal negative (–)	
9	ISO_ GND_MAIN	O	Isolated ground	
10	BP1_ID or BP2_ID	I	BP1 or BP2 probe identification signal	
11	INV_BP3SIG or INV_BP4SIG	–	BP3 or BP4 signal negative (–)	

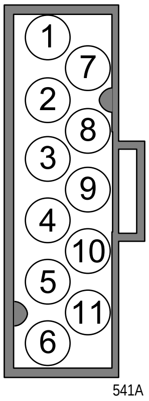
GE Pulse Oximetry (SpO$_2$) Cable Connector

The pulse oximetry function uses an 11-pin, female connector. The pinout is as follows:

PIN	SIGNAL NAME	I/O	DESCRIPTION	DIAGRAM
1	NELLCOR_RCAL	O	Nellcor probe characteristics ID resistor	
2	IR/RED*	O	Anti-parallel LED drive (low=RED, high=IR)	
3	RED/IR*	O	Anti-parallel LED drive (low=IR, high=RED)	
4	NC	–	Not connected	
5	POX+	I	Photo detector anode	
6	SHIELD	–	Cable shield	
7	NELLCOR_RCAL_RETURN	I	Return for probe characteristics ID resistor	
8	MARQUETTE_PROBE*	I	Marquette probe select	
9	POX–	I	Photo detector cathode	
10	NELLCOR_PROBE*	I	Nellcor probe select	
11	GND	–	Ground reference for pins 8 and 10	

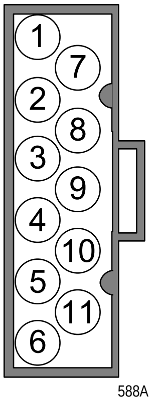
Masimo SET Pulse Oximetry (SpO$_2$) Cable Connector

The pulse oximetry function uses an 11-pin, female, “Nicolay-style” pulse oximetry connector. Special keying only allows the use of Masimo LNOP (low noise) probes. The pinout is as follows:

PIN	SIGNAL NAME	I/O	DESCRIPTION	DIAGRAM
1	DETECTOR_ANODE	I	Photodetector	 1 7 2 8 3 9 4 10 5 11 6 541A
2	DETECTOR_CATHODE	I	Photodetector cathode	
3	NC	–	Not connected	
4	NC	–	Not connected	
5	IR_LED_CATHODE	O	Anti-parallel LED drive	
6	OUTER_SHIELD	–	Inner cable shield - surrounds Detector_Anode and Detector_Cathode signal pair. Terminated directly to GND_ISO_MAIN via both wide copper traces and the silver epoxy shield layer of the flex circuit.	
7	INNER_SHIELD	–	Inner cable shield - surrounds Detector_Anode and Detector_Cathode signal pair. Terminated directly to GND_ISO_MAIN via both wide copper traces and the silver epoxy shield layer of the 2006782-001 flex circuit.	
8	NC	–	Not connected	
9	NC	–	Not connected	
10	RED_LED_CATHODE	O	Anti-parallel LED drive	
11		–	Outer cable shield - surrounds entire SpO2 cable. Terminated directly to GND_ISO_MAIN via silver epoxy shield layer of 2006782-001 flex circuit.	

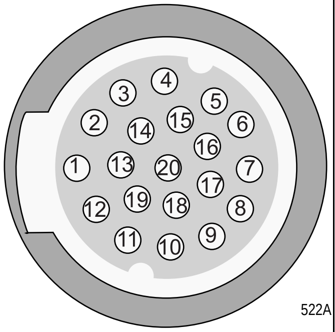
Temperature/CO Cable Connector

The temperature/CO function uses an 11-pin, female connector. The pinout is as follows:

PIN	SIGNAL NAME	I/O	DESCRIPTION	DIAGRAM
1	+0.25V_REF	O	+0.25 V sensor drive voltage	 1 7 2 8 3 9 4 10 5 11 6 588A
2	DT/CO_IN1	I	Input from temperature sensor, channel 1	
3	CO_OFFSET	I	CO offset	
4	NC	–	No connection	
5	700*/400_ID	I	Thermistor ID (LOW=YSI 700 Series; HIGH=YSI 400 Series)	
6	SHIELD	–	Cable shield	
7	AGND	–	Analog ground	
8	DT/CO_IN2	I	Input from temperature sensor, channel 2	
9	CO_PROBE_PRESENT	I	CO probe presence identification signal	
10	TEMP_PROBE_PRESENT	I	Temperature probe presence identification signal	
11	DGND	–	Logic ground (reference for pins 5, 9 and 10)	

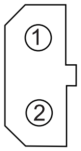
Capnostat III (CO$_2$) Cable Connector

Connection to the Capnostat III is via the Novametrix standard 20-pin circular connector. The pinout is as follows:

PIN	SIGNAL NAME	I/O	SIGNAL DESCRIPTION	DIAGRAM
1	SOURCE+	O	Capnostat Infra-red source drive positive (+)	 4 3 5 2 14 15 6 16 1 13 20 7 17 19 18 12 8 9 11 10 522A
2	SOURCE–	O	Capnostat Infra-red source drive negative (–)	
3	EE_CS	O	Chip select to 93C46 EEPROM within Capnostat.	
4	CO2_REF_IN	I	CO$_2$ reference channel signal input from Capnostat which is not affected by the presence of CO$_2$.	
5	CASE_HTR	O	DC voltage, generated from a software controlled PWM drive signal, which controls the Capnostat case temperature.	
6	CO2_IN	I	CO$_2$ data channel signal input from Capnostat which is affected by the presence of CO$_2$.	
7	EE_SCLK	O	Serial data clock to 93C46 EEPROM within Capnostat.	
8	HTR_RTN	–	GND return for pins 5 and 16	
9	EE_DATA_OUT	I	Data from 93C46 EEPROM within Capnostat (output from EEPROM).	
10	+5V	–	Logic supply voltage to Capnostat	
11	EE_DATA_IN	O	Data to 93C46 EEPROM within Capnostat (input to EEPROM).	
12	SPAN_SW*	I	Driven low to indicate that the Capnostat has been placed on the REF cell.	
13	SHIELD	–	Termination for both inner and outer shields of the Capnostat cable - is connected to the main DAS floating shield plane and cover.	
14	ZERO_SW*	I	Driven low to indicate that the Capnostat has been placed on the ZERO cell.	
15	CASE_THERM	I	Case thermistor (also used for Capnostat presence detection).	
16	DET_HTR	O	DC voltage, generated from a software controlled PWM drive signal, which controls the Capnostat detector temperature.	
17	DET_THERM	I	Detector thermistor	
18	–12V	–	Negative (–) analog supply voltage to Capnostat	
19	+12V	–	Positive (+) analog supply voltage to Capnostat	
20	AGND	–	Analog GND	

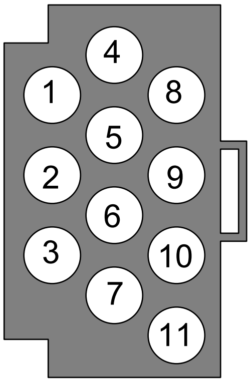
NBP Connector

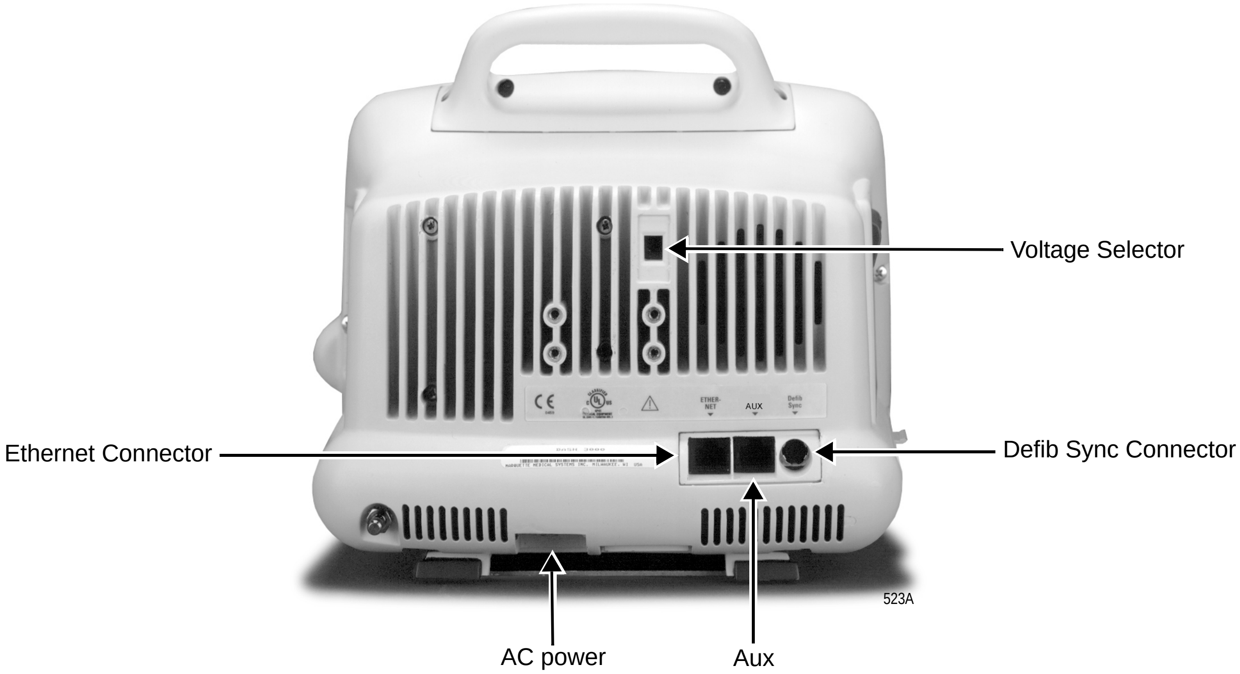
A pneumatic connector is used for the patient interface.

PIN	SIGNAL NAME	I/O	DESCRIPTION	DIAGRAM
1		I	Sensing Side (to pressure sensor)	
2		I	Pressure Side (pump, valves, overpressure sensor)	

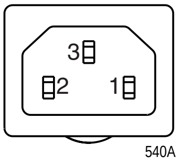
ECG Cable Connector

The ECG/Respiration function uses a recessed, 11-pin, female, ECG connector. The pinout is as follows:

PIN	SIGNAL NAME	I/O	DESCRIPTION	DIAGRAM
1	RA	I	Right arm electrode	 4 1 8 5 2 9 6 3 10 7 11 534A
2	V2	I	Chest electrode V2	
3	V3	I	Chest electrode V3	
4	LA	I	Left arm electrode	
5	RL	O	Right leg (reference) electrode	
6	V/V1	I	Chest electrode V1	
7	V4	I	Chest electrode V4	
8	LL	I	Left leg electrode	
9	V6	I	Chest electrode V6	
10	V5	I	Chest electrode V5	
11	SHIELD	–	Cable shield - connected to ECG shield plane and electrostatic cover	

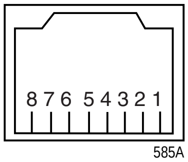

Voltage Selector
Ethernet Connector
Defib Sync Connector
523A
AC power
Aux

Power Entry Connector

PIN	SIGNAL NAME	I/O	SIGNAL DESCRIPTION	DIAGRAM
1	NEUTRAL	I	AC Mains Power	
2	LINE	–	AC Mains Power	
3	GROUND	–	Chassis safety grounded	

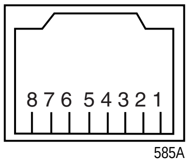
Network Interface Connector

An 8-pin RJ-45 connector containing two isolated, differential pairs is provided to connect the monitor to a network hub.

PIN	SIGNAL NAME	I/O	SIGNAL DESCRIPTION	DIAGRAM
1	LAN _TX+	O	LAN transmit +	
2	LAN_TX-	O	LAN transmit –	
3	LAN _RX+	O	LAN receive +	
4	NC	–	No connection	
5	NC	–	No connection	
6	LAN _RX-	O	LAN receive –	
7	NC	–	No connection	
8	NC	–	No connection	

Auxiliary Communication Connector

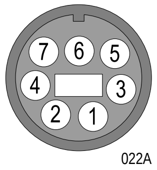
Auxiliary communication communicates with peripherals such as a remote control or data logger. The UART channel is only capable of communicating with external devices having the same transmit and receive baud rates. Power available to peripheral devices is current limited to 100 mA.

PIN	SIGNAL NAME	I/O	SIGNAL DESCRIPTION	DIAGRAM
1	AUTOPORT_+5V	O	Isolated +5V	
2	SPARE	I	Spare	
3	AUTOPORT_232_RX	I	RS-232 receive signal	
4	AUTOPORT_GND	–	Power return	
5	AUTOPORT_ID	I/O	Device identification signal - host side	
6	AUTOPORT_232_TX	O	RS-232 transmit signal	
7	AUTOPORT_+10V_RTS	O	RS-232 request-to-send signal (remote alarm control signal)	
8	AUTOPORT_+10V_DSR	O	RS-232 data-terminal-ready signal	

Defib Sync Connector

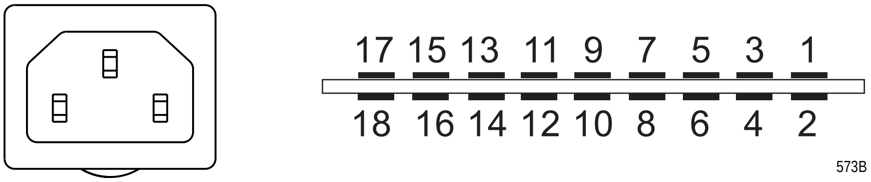
Analog outputs consisting of ECG waveforms including the pace pulse and the BP out are available through the 7- pin mini-DIN connector. The two analog outputs are calibrated by monitoring the outputs with a precision voltmeter while trimming the offset and gain adjustments with the Trim Knob.

BATTERY A BATTERY B

PIN	SIGNAL NAME	I/O	SIGNAL DESCRIPTION	DIAGRAM
1	MARKER_OUT	O	Digital defibrillator output synchronization signal	
2	MARKER_IN	I	Digital defibrillator input signal	
3	GND	–	Common return	
4	GND	–	Common return	
5	RESERVED	–	Reserved	
6	BP/RESP_OUT	O	Analog BP/RESP output signal	
7	ECG_OUT	O	Analog ECG output signal	

Peripheral Expansion Interface Connector

An 18-pin peripheral expansion interface is provided to support future use. An active low peripheral present signal may be polled by software to identify when a peripheral is attached to the monitor. Asynchronous, Aux, and a switched Ethernet serial communication channels are supported as well as switched +9-18V and +5V power.



Bottom View of the Monitor

PIN	SIGNAL NAME	I/O	SIGNAL DESCRIPTION
1	RETURN	–	Common power return
2	+9-18V	O	+9-18V power
3	PER_MARKER_OUT	O	Marker out
4	PER_ENET_PRESENT*	I	Signal to request switched Ethernet to peripheral
5	PER_ENET_TXD–	O	Transmit data + to peripheral
6	PER_ENET_RXD–	O	Transmit data – to peripheral
7	PER_ENET_TXD+	I	Receive data + from peripheral
8	PER_ENET_RXD+	I	Receive data – from peripheral
9	PER_AUTOPORT_ID_RXD	I	AutoPort ID RXD
10	PER_PRESENT*	I	Asserted by the installed peripheral device once powered
11	PER_ASYNC_RXD	I	Serial asynchronous data input from peripheral
12	PER_ASYNC_TXD	O	Serial asynchronous data output to peripheral
13	TC_PACER_BLANK*	O	Pacer blanking pulse from defibrillator
14	PER_AUTOPORT_ID_TXD	O	AutoPort ID TXD
15	PER_AUTOPORT_RXD	O	AutoPort RXD
16	PER_AUTOPORT_TXD	I	AutoPort TXD
17	+5V	O	+5V power
18	RETURN	–	Common power return

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